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The Government Farm at Babboor, Chitaldrug District. *

BY

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THE question of starting an Experimental Farm to work out the problems connected with the black cotton soil and its crops was a long-deferred one. The Farm was started in 1916 to satisfy this demand. In addition it has been made to serve the needs of the tract irrigated by the Vanivilas Sagara (known formerly as the Marikanave Reservoir). This was done with an eye mainly to economy. The situation of the Farm has thus been influenced by the main consideration of getting two contiguous blocks of land, one to represent the black soils on which the dry land crops such as jola and cotton could be experimented upon and the other a large block of irrigable land on which the problem of irrigated crops could be tackled. The Farm is situated about 3 miles east of Hiriyur Town which is 24 miles distant from Chitaldrug Railway Station and 99 miles from Bangalore, on the Bangalore-Dharwar Road.

Climate.—The climate of this tract of country is a very dry one with an average annual rainfall of 19 inches. The history of Vanivilas

* Accounts of the Government Farms at Hebbal and Marthur appeared in Vol. I, No. 2 and Vol. I, No. 4 of the Journal respectively.

Sagara makes it clear that the lake was constructed as a protection work against famine. The rains we get here are the Hingar *i.e.*, the North-East Monsoon and more than 75 per cent of the annual precipitation is in the months of September and October. It might interest our readers to be informed that during the year 1919–20 we got a rainfall of 10½ inches out of which about 9 inches fell within a month. During this year we have been able to gauge up-to-date only 5·20 inches of rain.

The extent of the Farm and nature of its soil.—The farm consists of 86 acres of dry land and 132 acres of wet land. The farm soil consists mainly of black soil in the dry land and red soil in the wet land. The black soil is situated on a gentle slope necessitating putting up of bunds to prevent washes during rains and it is not deep, being in some places only about 8 inches. None the less, the soils are retentive of moisture and fairly rich. There are patches of red soil also on the dry area but these form a small percentage of the dry area.

The wet land consists of poor red soil. It is very shallow and stony, not allowing the plough to cut more than 3 to 4 inches deep. It gets very slushy after irrigation, but a couple of days after, dries hard as brick. The lack of organic matter makes it difficult for cultural operations. The soil is, for the most part, alkaline, and the question of drainage is an important factor in crop production on this land. About ⅓ of the land was not under cultivation and some of it was under babool when the lands were taken over by Government for the Farm.

It might be noted here that the labour question is a very important one and it has not been possible to get adequate labour for the needs of the farm yet, so that with unfavourable seasonal conditions, poor gravelly and alkaline soil of the wet land and want of labour, the management of the farm is carried on under great difficulties.

Farm Buildings, Implements and Machinery.—The Farm office and stores, staff quarters, cattle-shed and cooly lines are located in the dry land. With a view to keeping down the capital outlay of the Farm these buildings are built of stone in mud with thatched roofs. In the wet land are situated the jaggery boiling furnaces, engine and mill house and a shed to cover the two double roller Platt-Brothers'

cotton gins. There is also an old terraced house which is being used as wet land stores.

The main plough used on the wet land is the "Verity" plough, a plough now well-known in the State. We have a small double mould board plough to open furrows for cane planting. There are "*dodkuntes*", a common local three-tyned seed drill, and an imported heavy clod-crusher which does not seem to be of much use, three turnwrest ploughs of a heavy type out of which one is the "Kirlosker" plough manufactured in India, the other two being the "Cockshutt" and the "Albion," these being used for deep ploughing of dry land and lastly, the "Gallows" plough of the Ransome Company, a heavy plough which turns out the best work. It is this plough that is used for ploughing in green manure crops for sugarcane. There are, in addition, disc harrows and lever harrows.

The machinery of the Farm consists of 10–12 Brake-Horse-Power Petter Engine which drives the sugarcane mill on the Farm. This mill is by Messrs. Massey & Co. of Madras, and has rollers 12″ x 18″. There is another sugarcane power mill of American manufacture called "Chattanooga mill" which turns out better work than the one described above. There are two double roller Platt Brothers' cotton gins and these are worked by the same Engine which works the mill, after the cane milling is finished. The cotton from local cultivators, in addition to farm grown cotton, is ginned at a rate which just covers the working expense.

Farm Crops.—The main crops that have been grown on the farm are cotton and jola (*Andropogan Sorghum*) in the dry land and sugarcane and irrigated cotton in the wet land.

Sugarcane.—This is a crop which is increasing in importance year by year as a money crop. The prices that are ruling now for jaggery have reached a stage when it behoves our ryots to seriously think of taking to cane-growing. It would be unpardonable if the ryots under Vanivilasa Sagara channels do not make their fortunes now.

Experiments with varieties of sugarcane show that Rasthali, the local cane, is by no means the heaviest yielder. Red Mauritius has proved to be far superior in tonnage to any other cane and consequently this is the cane that is grown on the farm. It occupies nearly 25 acres.

Many varieties of seedling canes are tested on the farm in addition to imported canes. There are a couple of seedling canes of Hebbal which are of great promise. These are 544 and 312. J. 33*a* is another variety which appears to suit this tract well. It is too early to make any definite recommendations as these have not been grown on a large scale. It is proposed to grow H. M. 544 and J. 33*a* on a large scale next year.

Spacing tests.—As has been noted already, the labour problem is very acute, and any scheme of cultivation recommended to the ryot must bear this in view. Growing sugarcane in rows so as to facilitate interculturing by bullock power is to be advocated. The experiments on this farm have proved, so far, that canes planted 4 feet apart, row to row, give the highest tonnage. This facilitates interculturing with the "*dodkunte*," a very common implement of these parts. There is one more advantage and that is a smaller number of cane setts is required per acre.

Manurial Experiments.—Manurial experiments with artificial manures have been started this year and it is hoped they will give results which will be very useful in improving the yields of an industrial crop like sugarcane.

Irrigated cotton.—This is an important crop. The variety is different from the one grown on the dry land. Both "Dodhatti" or Dharwar American and Cambodia cotton are grown under irrigation, but the ryots prefer to grow the former. Experiments were conducted on the farm and of the two, "Dodhatti" appeared to be the heavier yielder. It is premature to draw any conclusions as the results are from only one season. The fact that the cotton crop fits in well with wet land rotation which includes sugarcane, is so important as not to be lost sight of in laying out the crop rotation.

Fodder Jola to supply fodder for farm cattle is also grown under irrigation.

Miscellaneous crops like tobacco, chillies, groundnut were all tried on the wet land without success. Paucity of labour is mainly responsible for the failure but the poorness of soil and its texture have, it is thought, also contributed not a little.

Green manure crop.—The role green manure plays in agriculture is generally under-estimated here. It is almost a thing unknown to the local land-owners. But the time has come when the need for

growing green manure will be felt with increasing force. The area that is being brought under cultivation expands every year. The soil is shallow generally and very poor, and the ryot, if he wants to live by agriculture, must perforce attend to manuring as a necessary means of providing the crops with food. Not only this, the physical condition of the soil is anything but satisfactory. Either it is too wet or too dry to use the farm implements and the only means to make the soil behave better is by the addition of bulky organic manure. So that sooner or later — the sooner the better — the ryot will be forced to take to green manuring as the most economic means of increasing the humus of the soil. There are already signs of the ryots in this area awakening to this need.

The most important of the green-manure crops that are used on the farm are Sunnhemp (*Crotolaria juncea*), Cowpea (*Vigna catiang*) and Daincha (*Sesbania aculeata*). Judging by the weight of green material got for ploughing into the soil, sunnhemp stands first and cowpea comes next. Cowpea being a short duration crop is preferred on the farm. Daincha so far has not shown any tendency to compete with either of the two crops above referred to. In addition, it is woody and does not easily rot. But there is one thing in its favour. It is cattle-proof. The green manure crops are ploughed in for sugarcane crop.

Dry land cotton and its improvement.—Cotton is the one money crop in these parts which occupies the largest area. It is unfortunate that such an important crop should be treated so indifferently by the cultivator. The crop as seen in the ryots' field is a mixture of all types of cotton. The possibilities of improving cotton therefore are admitted. Though this aspect of the problem involves plant breeding work on scientific lines, it has to be conceded that, if there should be any immediate improvement of cotton, it is through selection. Hence the work of the improvement of cotton, which is handled by a special officer, has progressed well on these lines. There are two types of cotton which have given higher yield than the local cotton. They are pure strains. One of them has a stronger lint; the other gives a higher percentage of lint. The seeds of these improved strains of cotton have been sown on a scale this year and pure seeds will be made available in the coming season. These selected types are Nos. 45 and 69.

Similar work on Jola is also in progress.

Other crops, such as Bengal gram, wheat and safflower, are also grown in very small areas in the dry land.

Notes on the more Important Insect Pests of Crops in the Mysore State.

BY

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(Continued from our last issue.)

II. Lepidoptera.

Caterpillar pests.

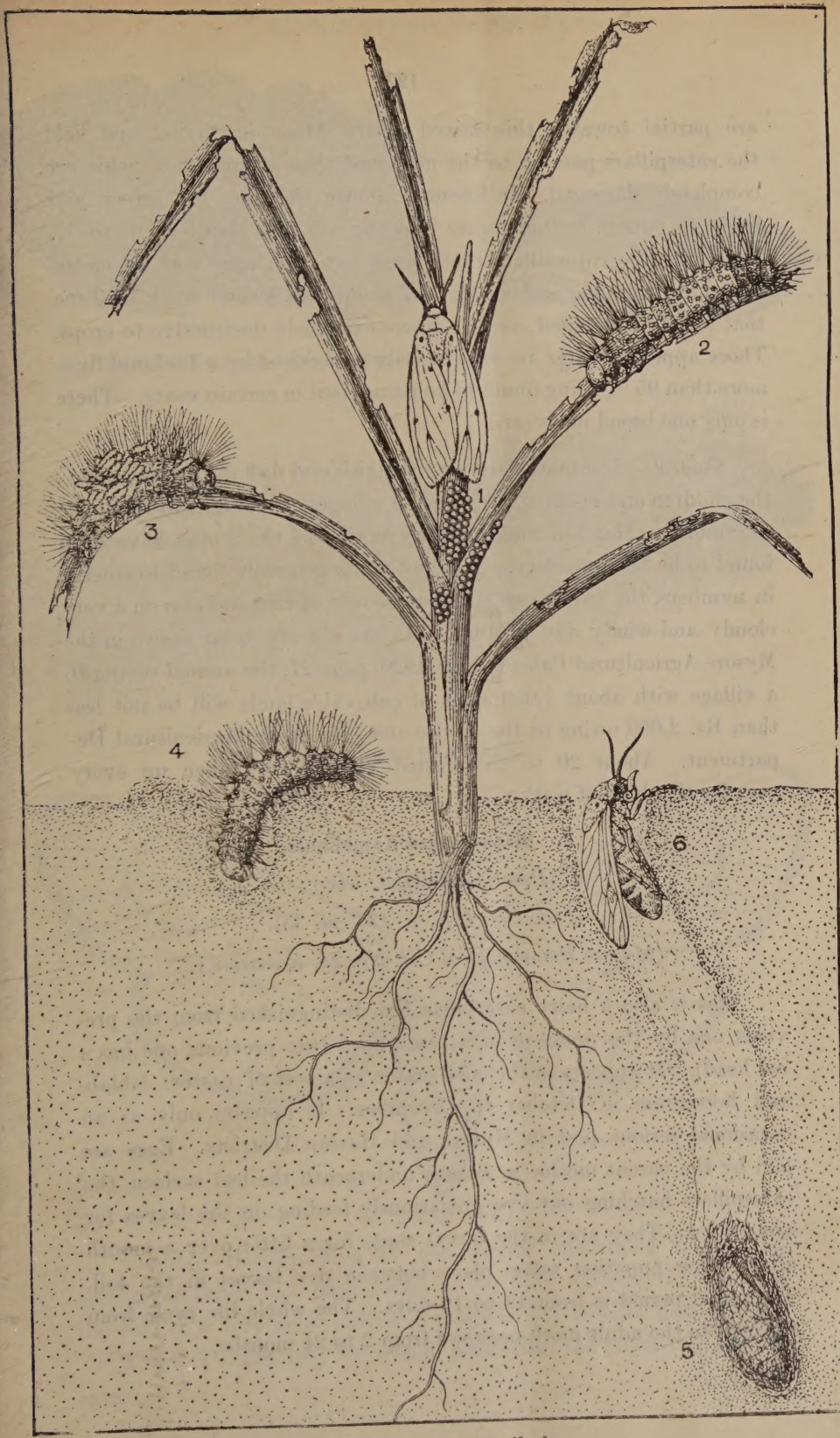
THESE form one of the important pests of crops which are damaged in a variety of ways — some eat away the leaves of plants wholesale, some are stem and fruit borers, while others live in the earheads of jola and ragi and damage the seeds. The most important of the caterpillar pests occurring in the State are :—

1. Kamblihula or Korihula.

(*Amsacta albistriga, wlk.*)

(*Mysore Entomological Bulletin, No.* 3, *Cir. No.* 15, *Kanarese.*) *Cir. No.* 21, *Mysore Agri. Cal.* 1919, *p.* 16, *Cal.* 1920, *p.* 16.

This is a hairy caterpillar doing very serious damage to early sown crops in several of the dry areas of the State. The pest is found only in soils of a sandy, sandy-loam and loamy nature. The moths emerge in large numbers from about the last week in May up to the end of the first week in July every year. The moths lay a large number of eggs — about 600 to 700 for each female moth — on weeds, dry twigs and particularly on the stumps of the previous season's togari (red gram), jola, castor, etc., left unploughed in a large number of fields at this time. The eggs hatch out into very tiny caterpillars in 4 or 5 days after they are laid and these insects begin attacking the early sown crops *viz.*, gingelly, jola, togari (red gram), pundi (*Hibiscus cannabinus*), blackgram, cotton, etc. Togari and pundi are always sown as a mixed crop along with jola, and the caterpillars



Kamblihula or Korihula.

are partial towards this mixed crop. After destroying one field the caterpillars pass on to the next and thus a number of fields are completely damaged. In about a month they get full grown and begin to pupate by burrowing into the soil to a depth of 6″ to 9″. It is only the caterpillars that hatch out from eggs laid by moths emerging from the end of May to about the second week in June that are to be dreaded, as they prove extremely destructive to crops. Those appearing later are very heavily parasitised by a Tachinid fly—more than 95 % being found to be parasitised in certain years. There is only one brood in a year.

Control.—The moths are very sluggish and dull during day time ; the children and ryots of the infested villages are taught to recognize the moths. Hand-picking and destruction of the moths have been found to be very effective. The moths are generally found to emerge in numbers, the 3rd day after a good shower of rain and also on a very cloudy and windy day in June. As has already been shown in the Mysore Agricultural Calendar for 1920, page 21, the annual saving to a village with about 1,000 acres of cultivable lands will be not less than Rs. 2,000 owing to the advice and help of the Agricultural Department. About 20 to 25 infested villages are taken up every year for this kind of work.

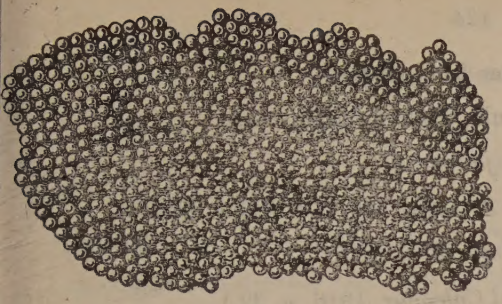
2. Black-headed Kamblihula.

(*Diacrisia obliqua, wlk.*)

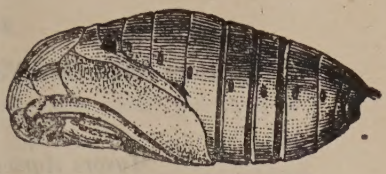
(*Ind. Ins. Life, p.* 437, *pl.* 35)

(*Mysore Entomological Cir. No.* 23, *Kanarese.*)

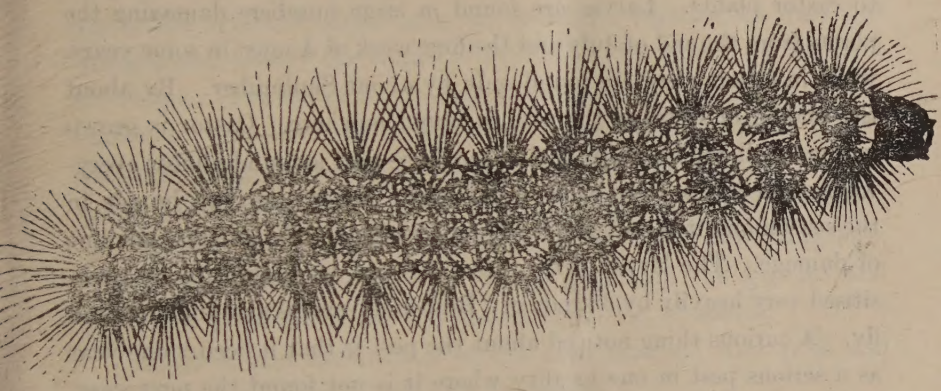
This is also a hairy caterpillar but distinguished from the previous one by the presence of a black-head (the previous one has a red head). It appears in the cold season as a pest of castor, lablab, and horsegram in October to December. It appears only as an occasional serious pest in Mysore and Hassan Districts. Eggs are laid by the parent moths in masses underneath the leaf surface, the caterpillars hatching out live gregariously feeding on the leaves for some days. They are in the larval stage for a little over a month after which pupation takes place between dry leaves in the soil. The pupal period is from 12 to 19 days. The whole life cycle from the eggs to the adult moth occupies from 2 to 2½ months.



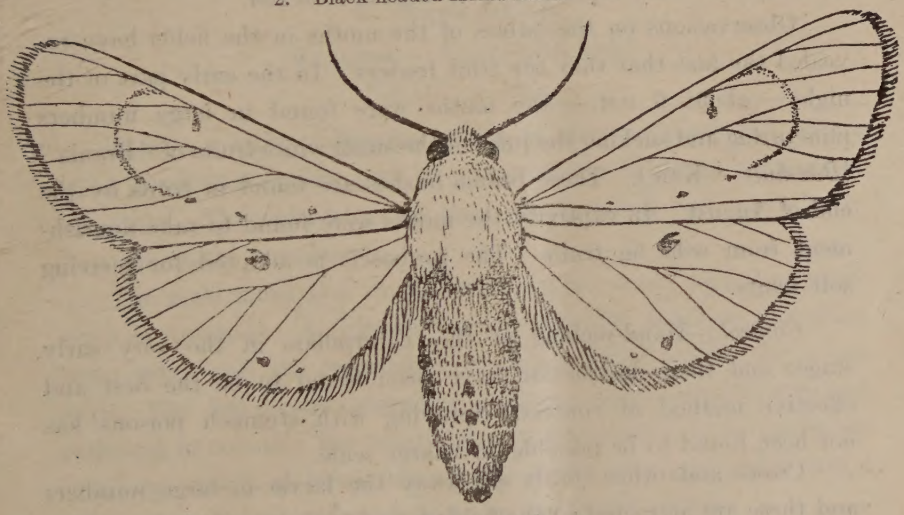
1. Egg mass of Black-headed Kamblihula.



3. Pupa.



2. Black-headed Kamblihula.



4. Female moth.

Control.—Hand-picking of the leaves containing the young gregarious larvæ has been found to be very effective in checking the pest to a very great extent in many of the villages near Mysore.

There is a Tachinid fly which parasitises the larvæ to a certain extent.

3. Castor Semi-looper.

(Kan. Kondali hulâ, Halu-kondali, etc.)

Achœa janata, Dr.

(*Mysore Ento. Cir. No.* 16, *Jr. Mys. Agri. & Exptl. Union. Vol. II, July* 20, *p.* 123, *Mysore Agricultural Calendar*, 1916, *p.* 22.)

The smooth and elongated caterpillar does a great deal of damage to castor plants. Larvæ are found in large numbers damaging the plants from the end of July and the first week of August in some years, while in others they are found only by about September. By about the middle of October the pest is found nowhere. Castor is grown in almost all dry lands in the State and the pest is found almost everywhere and has a very wide distribution. There are two broods in the season and it is only the first brood that does the greatest amount of damage. The larvæ of the second brood was found to be parasitised very heavily by 3 kinds of "Braconid" wasps and one Tachinid fly. A curious thing noticed about the pest is that it occurs one year as a serious pest in one locality where it is not found the next year. In many cases only a portion of the field is attacked.

Observations on the habits of the moths in the fields have revealed the fact that they are fruit feeders. In the early part of the night — about 9 P.M. — the moths were found in large numbers puncturing and sucking the juice of the small white fruits of "Brania" (*Bile-huli* — Kan.). These brania bushes are found in fruits by the end of August. In captivity the moths were found to take nourishment from wild fig fruits. The proboscis is adapted for piercing soft fruits.

Control.—Hand-picking of the caterpillars in the very early stages and their destruction have been found to be the best and effective method of control. Spraying with stomach poisons has not been found to be possible on a large scale.

Crows and other birds eat away the larvæ in large numbers and these are attracted to the fields by scattering cooked rice. This method is practised successfully in many parts of the State.

When there is no castor crop in the fields the insect is found to breed on stray castor plants grown in gardens and back-yard of houses. Destruction of these plants may be found very useful to some extent.

4. The Castor-pod borer.

(*Dichocrocis punctiferalis, Gn.*)

S.S.I.I., p. 133.

This is a pest wherever castor is sown in the State. It occurs generally in October–November. The larvæ are small pale pinkish in colour and destroy the crop by boring into the seed capsules and shoots. The moth is a small bright yellowish creature with black spots on the wings. The presence of the insects is very easily made out as the attacked castor pods are all bound together by frass and webbing and also by the tunnel formed of the frass, etc., on the main fruit-stalk. The insect has a very wide range of food plants. It is known to bore into the rhizomes of ginger and turmeric, flower-stalks of mango blossoms, guava and peach fruits, in other parts of India. It is found to breed in large numbers on the flower heads of "Rajeena," (*Amaranthus gangaticus*) in March in Bangalore.

Control.—Removal of stray castor plants in the gardens and backyards of houses where the insects breed out of season.

Removal and destruction of the first attacked fruit pods and the tunnels on the fruit-stalk with the insects.

5. Orgyia postica.

(Kanarese — *Urukondali hula*)

S.S.I.I., p. 395.

This is a hairy caterpillar which is very common and occurs as an occasional serious pest of castor in the Northern portions of the State. The cultivators of those tracts dread the insect more than the castor semi-looper.

The male moth is a small active winged insect and the female moth is apterous. A number of eggs are laid together and when these hatch out, the caterpillars remain together feeding for a few days. The full-grown caterpillar is hairy, about one inch long and yellowish in colour. The caterpillars are very easily made out by the two long pencils of hairs coming out of the anterior portion and 4 thick tufts of short yellowish hairs on the dorsal surface.

The caterpillars appear by about September-October and do considerable amount of damage to the castor crop in certain years.

Control.—The best and effective remedy is to gather the leaves on which the young caterpillars are clustered together and destroy them.

6. Sann Hemp Caterpillar.

(*Utethesia pulchella, Linn.*)

S.S.I.I., p. 371. *Rep. Pros. Sec. Ento. Meeting, Pusa, p.* 66.

This is an occasional serious pest of Sann Hemp and occurs wherever the plant is grown in the State in March-April. The caterpillar is very slender and shows very great variation in colour. There is a mixture of white, black and red colours, with a few scattered stiff hairs all over the body. The caterpillars eat away the leaves of the plant, bore into the pods and eat the seeds. The moth is small, whitish in colour with red and black spots on the wings.

Control.—Hand-picking and destruction of the caterpillars in the very early stages of the attack, although a tedious operation, has been found fairly effective in checking the pest to some extent. Spraying with lead arsenate and Paris green was effective on a small area in the Experimental Farm.

7. Ragi earhead Caterpillar.

(*Simplicia Robustalis, Gn.*)

S.S.I.I., p. 395.

(*Mysore Ento. Cir. No.* 24 — *Kanarese.*)

This is a small smooth brownish caterpillar found as an occasional serious pest on the ragi earheads in the stack, in the thrashing floors. It occurs in the cold season, November-December-January. It is found in Chickmagalur (Kadur District) and Tumkur. The caterpillars occur in large numbers in ragi stacks, the ear heads are found webbed up and the grains cut up and broken. Large quantities of the grain mixed up with the excreta of the larvæ are found below and around the stacks.

The caterpillars were found crawling about outside the stack in the cool hours of the mornings and by 10 A.M., they are found to hide inside the stack. The moths are small and dark brown. They were found to hide between the sheaves of straw in the stack during day time and at dusk they were found resting here and there in weeds, etc., around the thrashing floor. When the stack is disturbed by beating with a stick the moths suddenly dart out and after a zig-zag flight for some seconds, suddenly dart back and gain entrance into the stack through the small spaces between the straw. The moths are not attracted to light or to baits of molasses.

Control.—Thrashing the ragi, immediately the presence of the insects are noticed, is the best and effective remedy.

(*To be continued*)

The Blackgram Beetle mentioned in the last issue of the Journal has been identified as *Apion amplum, Fst.* It is known to breed on greengram pods in the Madras Presidency.

The life history of the insect *Sagara nigritia* mentioned in volume 3, No. 1, page 16, of this Journal was worked out by Mr. (now Dr.) K. Kunhi Kannan, Senior Assistant Entomologist.

Agriculture in the French War-Zone, I.

BY

W. Davison, B.S.A.,

Live Stock Expert in Mysore.

"Some talk of Alexander and some of Hercules
Of Hector and Lysander, and such great names as these"

and even the allotment holder during the war got his meed of praise. both seriously and in a humourous vein ; and yet how many outside of their own compatriots and those others who saw and lived with them, realize the heroism of French and Belgian peasants in the "danger zone" ? Heroism, not of the kind which is accomplished in the heat of battle, but a heroism none the less, inspired just as much by the love of country as that of the bravest soldier, and accompanied by the dangers of war only to a lesser extent. Remember too that the farming operations in those countries were conducted during those trying days by the aged and infirm of both sexes, with the help of the under-aged youth and the women of all ages. Yet the dogged determination to carry on at all costs and the tolerant and hospitable spirit which smiled on the raids of the soldiers on vegetable gardens and chicken roosts, carried "all that was left" of the population of those districts to a victory of their own, and helped in no small degree to bring about the victory of the allied armies.

At times that same earnest determination to stand by the old home often exercised the area commandants and town majors when looking after the safety of the people and endeavouring to persuade them to move to places less fraught with danger. My friend Leon, (his other name I forget if I ever knew it) whose farm in front of Kemmel Hill had suffered the loss of most of the stock and nearly

all the buildings, was as full of plans for the breeding of his remaining stock, and as such exercised over the use of a suitable sire for his team of Belgian mares on the morning after the wall of his kitchen had been blown down by a six inch shell as he ever was in his prosperous pre-war days. A keen old horse-man, ever ready to criticise the English and Canadian horse to the glorification of his beloved Belgian breed, he spent most of his evenings that winter and in all probability all other winters, helping his wife to prepare "eggs and chips" for his friends in the unit and discussing the comparative merits of the respective breeds. Occasionally he dug out of the garden a special bottle of "vin rouge" which had been buried from the Germans and left in the ground ever since for safety. On such gala occasions the discussion outlasted the bottle. Things got too hot for him in the end and he had to withdraw his family to share farm buildings further back, but on visiting him on a return to that part of the line eighteen months afterwards I found him still farming his land with the help of his wife and his precious pair of mares. "Que voulez-vous"? "C'est la guerre"! was his answer to my expression of surprise. C'est la guerre, an expression used by all, to sum up the situation. A nuisance, and deuced inconvenient, but still we must do what we can and take things as they come; accidents and troubles are bound to happen in war, but that is no reason for giving up. Que voulez-vous? C'est la guerre!

My first experience of the innate determination of the French peasant was in front of Cappy in the Peronne. An old man of about 70 years of age was ploughing right in front of the battery and was quite disturbed when he was told that he must move as some firing was to be done. However he conceded a point and moved to the next field, where his old grey team could be seen at work all the rest of the day. The next day he was back to ask if he could plough the first field, as he wanted to sow wheat and it was time it was done. During the rest of our stay in that position he was to be found at work in one part or another of his land. His three sons were in the French forces and he took a keen delight in talking to the gunners of the unit, many of whom would go out in off hours, one driving his team while another regaled him with tobacco and carried on a difficult conversation in that weird mixture of language and pronunciation which the British soldier called French and the French

peasantry called English. Whether the old veteran's efforts were rewarded or the field blown full of holes we never knew, but when we moved the indications were that either might happen.

An example of the faith which was put in the Allies may be taken from the rapid way in which the farmers filled up trenches and moved into hitherto inaccessible land after an advance. The thought that retreat might be necessary, if ever indulged in, was certainly not evident on such occasions.

And so one could indulge in many reminiscences. Memories of the boy of fourteen, an only surviving son of an old widow, who had his hand blown off and narrowly escaped death by a Mills bomb which had obstructed his plough while cultivating a newly recovered piece of land, and of his return to continue his work after recovery. Of the old couple and their two pretty daughters in Aix-Noulette, who remained at their post after the farm house had suffered two direct hits and lost its entire roof as a result of the explosion of an ammunition dump. The dump, which had been hit by the Germans, was not more than a hundred yards away from the farm house. These people still kept up a delightful garden and the two girls gave to their father the only assistance he had on his farm, for at that time they were practically the only inhabitants of the village.

I remember in 1917, after the capture of Vimy Ridge, upon which our battery was in position, a man well past middle age, who came forward with a special pass to look for his farm. The whole ridge was so badly devastated, and the havoc wrought by shell fire and mine explosions was so great that this man who had lived there for most of his life was unable at first to locate the spot. However, eventually, by using a pile of debris which was identified as the site of a road, as a base line, and a wood very much altered in its appearance as a bearing, the farm was found. It consisted chiefly of two enormous mine craters, known as the Twin Craters, which presented very little agricultural prospect. After wandering about for some time, the real owner of this "property" went back whence he came, with the remark that, though he no longer owned a farm, he at least owned two of the biggest holes in France.

These, typical of the many instances which occurred, are picked at random from a number which occurred within my own experience. Thousands of others who found themselves under similar

circumstances to myself in different parts of the line could add many more, some of them doubtless giving evidence of greater determination and courage on the part of the French and Belgian farmers than those cited above. They could add their voice to mine in paying tribute to those people who laboured, "unhonoured and unsung," under the most strenuous and difficult conditions towards the support of their country and themselves, not only by the production of foodstuffs, cattle and horses, but also by sustaining a morale which had a great reflex action on the armies in the country, and on the general national spirit. To this may be attributed in no small measure the speedy and solid success which had attended the work of rehabilitation and restoration of the devastated area in France and Belgium since the Armistice of 1918.

Our Members and Their Work.

Results of Plough Trials.

DURING the ploughing season 1920, the Hebbal plough designed and constructed by the Department of Agriculture was supplied to fifteen members of the Union on the understanding that the plough should be used through one ploughing season and that for not less than 5 acres of land should be ploughed. The following list of questions was drawn up by the Agricultural Department and supplied with the plough :—

1. Type of soil.
2. Condition of land — dry (sod or stubble), wet.
3. Ease or difficulty of the penetration of the bar-point into the soil.
4. The turn-over of the soil on the mould-board.
5. Steadiness of the plough in work.
6. Type of cattle employed and the nature of the pull.
7. Average width and depth of furrow.
8. The quality of the furrow as a clean cut one, bottom free from ploughed soil or otherwise.
9. Amount of work done per day of 10 hours.
10. The wearing of parts expressed in acres for each part worn.
11. Defects or merits as compared with other types of ploughs used by experimenter in same class of soil.

The following reports sent in by members are published for information. In the second and subsequent reports, opinions were either not expressed on certain points or were identical with those in Report I. These are therefore omitted.

As the result of trials reported here and many others conducted in various parts of the State, certain alterations were made in the design and construction of the ploughs and a few ploughs made at the M. S. M. Railway work-shop of better material than that used for the ploughs under report were given out again to members for trial. Reports on the trial of these ploughs are generally very favourable and will be published in the Journal later on.—[*Secy.*]

REPORT I.

Hebbal Plough compared to Kolar Mission Plough.

Mr. H. Sreenivasa Rao, Retired Deputy Conservator of Forests, Hongenahally, Malur Taluk.

1. Sandy.	1. Clayey.
2. Dry land (sod).	2. Dry land (sod).
3. Bar point penetrates the soil easily.	3. Not so easy on this soil.
4. Turns over the furrow slice well.	4. Turn over not satisfactory. After the plough passes, the cut soil sometimes falls into the furrow.
5. In steadiness, inferior to Kolar Mission plough.	5. Not steady compared to Kolar Mission plough.
6. Strong bulls of the *Hallikar* breed and also a small pair of country bullocks. Pull—heavier than K. M. plough.	6. Strong pair of *Hallikar* breed and also a small pair of country bullocks. Pull—heavier than K. M. plough.
7. Depth $4\frac{1}{2}$ inches, width about $\frac{1}{3}$ inch, broader than K. M. plough.	7. Depth $3\frac{1}{2}$ inches. Width slightly broader than K. M. plough.

8. Furrow—clean cut though not as satisfactory as that made by K. M. Plough.	8. Furrows not clean, as the bottom is not even. The left side of the furrow where the bar point penetrates is grooved and the remaining portion of the bottom on the right side is not flat but uneven.
9. About 12 to 14 guntas in a day of 7 hours. This depends on the nature of the bullocks.	9. About two guntas less than in sandy loams.
10. Both K. M. and Hebbal ploughs are working together. Parts of Hebbal plough wear out much more slowly than those of K. M. plough. This season 4 shares have been replaced for K. M. plough but none for Hebbal, though both work together always.	10. Both ploughs work together. Parts wear out slower than K. M. plough parts. The shares have been replaced 5 times in K. M. but not in Hebbal, though both work together always.

11. Hebbal plough, as constructed at present, though good enough for sandy loams and loamy sands, is not as efficient as K. M. plough. It is much behind the K. M. plough in point of efficiency in clay soils. On the whole it is next to K. M. plough in every way except in the width of the furrow and the durability of the working parts.

The share and the mould board of the Hebbal plough are thinner compared to similar parts of K. M. plough.

Defects of the Hebbal Plough.

(*a*) The share not having been properly fitted turns to a side and overrides the mould board at one corner. This has to be brought to position often by beating. This is the defect in both the Hebbal ploughs supplied.

(*b*) In clay soils the bar point does not penetrate deep in ploughing the sod. In sandy loams it is good.

(*c*) Much grass sticks to the point and earth also sticks on, which interferes with the free inversion of the cut soil. This makes frequent removals necessary.

(*d*) In inversion of the soil only next to the Kolar Mission plough.

(*e*) Heavy to draw compared with the Kolar Mission plough.

(*f*) Stilts a little too high.

REPORT II.

Mr. A. S. Venkatakrishnappa, Shanbog, Arekere, Tumkur taluk.

1. Sandy loam, both wet land and dry land.
2. Dry.
4. Does not turn as well as the K. M. plough.
6. Bulls worth Rs. 300 were used.
7. Depth $3\frac{1}{2}''$ to $4''$, and width $5''$ to $6''$.
8. Furrow not clean cut. Part of ploughed soil fell back into the furrow.
9. $\frac{3}{4}$ acre in dry land and 25 guntas in wet land.
10. Share and land-side wear out in ploughing during two seasons *i.e.*, 45 acres. Bar wore out only $4''$ in ploughing $7\frac{1}{2}$ acres.
11. Parts not well fitted. If the mould-board is improved and the plough is better constructed, this plough will easily take the place of the K. M. plough.

REPORT III.

Mr. B. Sreenivasa Iyengar, Jodidar, Anekal, Bangalore Dist.

3. Sucks the soil well even when the soil is dry.
10. The socket through which the bar is inserted wears out very soon with the result that space is left between the bar and the socket; weeds stick in and some quantity of soil also gets in and the opening gets widened.

The land-side might be shortened so as to lessen the total weight. Metal does not take polish and increases draught.

REPORT IV.

Mr. M. S. Linge Gowda, Vasantapur Estate, Bangalore Taluk.

6. Draught heavier than New Bar Share and Syracuse ploughs.
7. Turns the soil better than the K. M. and New Bar Share ploughs.

The Cultivation of Irrigated Ragi (*Eleusine coracana*) in the Maddagiri Taluk.

BY

C. B. Krishnamurthi,

Agricultural Inspector, Maddagiri Range, Tumkur District.

THIS is grown in paddy fields as rotation with summer paddy when there is not a sure supply of water to raise a paddy crop in winter. This has been the case in almost all the villages I have visited in this taluk. The ryots take a paddy crop in summer and raise an irrigated ragi crop in winter. The nursery is raised on a well prepared and manured piece of land and seedlings are transplanted when they are about 20 to 30 days old. Just before transplantation the land is well prepared, manured at 10 cart-loads of sheep manure and 5 cart-loads of farm yard manure per acre. Where sheep manure cannot be had, a dose of 10 to 15 cart-loads of farm yard manure is applied and the land fairly levelled. Just on the day of transplantation, the field is flooded with water and transplantation commences. The Vaddar and Gollar class people are engaged for this work and 8 female coolies transplant an acre in a day when the seedlings have grown luxuriantly in the nursery. Ten to fifteen coolies are said to be required if the growth is stunted. The one peculiarity which is to be noted here is that all the people practise single seedling transplantation and they say that they use single seedlings for transplanting paddy also. They say that this system is in vogue from a long time. They do not use more than one seedling even if they are asked to do so; they have found out the advantages of single seedling transplantation to such an extent. The ryots whom I met told me that they use only 15 to 20 seers of paddy for seed per acre.

Soon after transplantation is over the land is allowed to dry for 15 days. After 10 or 15 days a flood irrigation is given to the crop and after two or three days or just when the land is in a position to receive **chippukunte* the whole field is intercultivated and after 12 or 13 days another flood irrigation is given, if necessity arises. The crop is nearly a month and a half old by this time and vigorous

* Blade harrow.

growth commences. The whole crop is in flower a month or 5 weeks after the seedlings are transplanted, and comes to maturity when it is 3 to 3½ months old. Then the earheads are picked from the plots and stacked separately. They are well dried and then threshed ; the yield will be from 12 to 13 *pallas* per acre. I heard a man stating that he got 18 *pallas* of ragi from one acre of land last year. The straw is allowed to be grazed on the field by some ryots, others cut it and stock for feeding at home. Anyhow the straw is said to be very weak and not so sweet and nourishing as the dry land ragi straw. The cost of cultivation is as described below :—

COST OF RAISING NURSERY ON 1/30 ACRE PLOT.

	Rs.	a.	p.
6 Ploughings with country plough	1	0	0
Sheep manure, 1 cart load	2	0	0
Breaking clods, removing weeds, spreading manure, etc.	0	12	0
Seeds 4 seers, at 8 seers a rupee	0	8	0
Irrigation charges, etc.	0	8	0
Total ..	4	12	0

COST OF PREPARING ONE ACRE OF LAND.

	Rs.	a.	p.
Three ploughings with country plough at Rs. 2–8–0 per ploughing	7	8	0
15 Cartloads of farm yard manure at Re. 1 per cartload	15	0	0
Breaking clods 2 men, spreading manure 2 men or 2 women and removing weeds, 2 women	2	4	0
Levelling with country* *Halube*, 1 man and a pair of bullocks, for one day	1	0	0
Opening irrigation channels and repairing bunds, 2 men	0	12	0
Flood irrigation and levelling while planting, 3 men	1	2	0
Transplanting, on an average 10 female coolies ..	1	14	0
Irrigating and thinning, 1 pair of bullocks and 2 men	1	6	0
Weeding 6 women and 1 man for 1 full day ..	1	8	0

* Harrow.

	Rs.	a.	p.
Picking earheads when they are ripe, at the rate of 8 women per acre	1	8	0
Cutting straw, at 4 women per acre	0	12	0
Threshing cut earheads, stacking straw, etc. ..	5	10	0
Total ..	40	4	0
Total cost including the cost of raising nursery ..	45	0	0

YIELD.

	Rs.	a.	p.
1,400 seers of ragi at 10 seers a rupee	140	0	0
1,000 lbs. straw at 50 lbs. a rupee	20	0	0
Total ..	160	0	0
Deduct Total cost ..	45	0	0
Net Profit ..	115	0	0

At the current market rate, the yield from grain alone will be Rs. 175 which means a net profit of Rs. 130 per acre. The crop comes to maturity in about $2\frac{1}{2}$ months on the field; the income which can be expected from one acre of wet land within the short period of $2\frac{1}{2}$ months in seasons of scarcity of water without requiring much labour and capital is really a large one and the introduction of this new crop in localities where it is not generally grown is well worth the trouble. The variety used is called "*Konana Kombina ragi*" which is a very heavy yielder and is generally grown under irrigation.

From Our Co-operators.

being brief statements of the results of actual tests conducted by the farmers of the State of the various recommendations of the department, with their opinions and suggestions thereon.

I

A

H-22 Ragi in Sabbanahally, Goribidanur.

Three years ago, I purchased 50 seers of Madayyanagiri (H-22) ragi from the Department of Agriculture. I sowed the whole quantity and got a bumper crop. The next year I sold out to the Department and to ryots about 20 pallas of seed ragi of this variety. This year we have sown a hundred acres with this variety. The crop has just been harvested.

This variety of ragi yields 30 per cent more than our local varieties. This is our experience successively for three years.—*T. Lakshman Reddy, Jamindar, Sabbanahally, Goribidanur.*

B

H-22 Ragi in Bindiganahally, Hoskote Taluk.

Last season 640 seers of H-22 seed ragi were purchased by me at the advice of the Agricultural Inspector. The seed was distributed among 30 cultivators. At the start the cultivators felt rather nervous to try the ragi and they however did sow it after being persuaded to do so. A small quantity of this ragi which was left over after sowing was converted into meal and used by me. The ragi ball was astonishingly nice being of the consistency of bees wax. This gave me entire satisfaction of the ragi.

As regards the crop, the areas sown with this variety were growing more vigorously than the areas sown with local ragi. The ear heads bore more spikes and they were very much larger than those of the local variety. The crop suffered very much from drought. I had grown four acres which yielded 12 pallas of ragi. I had sown 2 acres with local ragi which yielded only 2 pallas of ragi. Thus the variety of ragi yielded 3 times as much as the local ragi. The ryots of this part are immensely pleased with it and the area under this variety of ragi is sure to expand in the coming season.—*Byre Gowda, Bindiganahally, Hoskote Taluk.*

C

H-22 Ragi in Siddlaghatta, Kolar District.

I have sown 3 acres with H-22 ragi which I purchased from the Department of Agriculture. The soil is gravelly red.

The land on which I have grown this ragi was not under cultivation these 20 years. It was banjar land which I purchased under the 'Large Landed Estates' Scheme. Two acres out of the three were ploughed with the Hebbal plough which I had taken from the Department for trial and the other acre was ploughed with the country plough. On the plots ploughed with the Hebbal plough grass and other weeds had been uprooted and later on they dried up. Much grass remained unremoved in the plot which was ploughed with the country plough The improved plough is more useful than the country plough under such circumstances.

The fields of my neighbouring ryots are being cultivated every year. They sow the Hullubele and other local types of ragi. My lands received less manure than their's. A month after sowing, we received no rain continuously for 25 days. The crop on my land did not dry up as did that on the land of my neighbours, but was actually green. But the crop on my land ploughed with the country plough did show signs of drying. This was a matter of surprise to the neighbouring ryots In the fields where the local ragies have been growing, there are not more than four to five spikes on each earhead and the spikes themselves are short. There are six to eleven spikes per earhead on my field and each spike is double as long as the spikes of local ragi. The ryots of tens of villages who pass by the Bushetthally road have been eye-witnesses of all this and it is a wonder to them ; so much so that I am worried for seed of this variety. My crop has been estimated to be double as much per acre as that of local ragi. I shall give the exact yield after threshing. The present estimate is 8 pallas per acre. Had timely rains been received, I should have got ten to fifteen pallas per acre. On my neighbours' fields I noticed that some earheads were ripe and others only half so. But in my field the whole crop ripened at the same time. Ryots in various parts have found by experience that H-22 ragi is a superior yielder to theirs. They wish to sow this variety during the coming season. I am ready to supply seed and shall take care not to mix it up with other varieties. Not only am I sowing a larger area with this variety myself but my neighbours will do so too.—*S. Hampayya, Jamindar, and District Board Member.*

II

A

Ammonium Sulphate on Sugar-cane.

I purchased 25 pounds of Ammonium Sulphate at the instance of the Agricultural Inspector and applied it to my sugarcane crop

which was badly diseased when it was four months old. The manure was applied over an area of four guntas of land, the soil at the roots being nicely stirred and well mixed with the manure.

Fifteen days after the application of the manure, the crop put on a dark green and healthy appearance. Compared with the unmanured portion, the manured portion had put on a more vigorous growth. The application of this salt to sugar-cane crop has a decided advantage. I could not find out by actual weighing the yields of jaggery from the manured area and the unmanured one, as my sugar-cane crop was sold away wholesale for seed purposes.

I am trying the application of this salt over a larger area this season.—*Nanjedevaru, Patel of Bidalur.*

B

Ammonium Sulphate as Manure for Sugar-cane in Ganerlahally, Bowringpet Taluk.

It is a matter of great satisfaction that in recent years the Agricultural Department have been taking much pains with regard to the investigation and introduction of improved implements, useful manures and the like. The proof of their work is that every one of the ryots who has come in contact with them has been unhesitatingly adopting the recommendations of the Department.

It is a matter within the experience of every ryot that in spite of all the interest he takes in regard to the proper cultivation of sugar-cane, the result at the end of the season is not satisfactory. I sought the advice of the Agricultural Inspector, Kolar, in this matter and explained to him our method of cultivation, manuring, etc., of sugar-cane. He requested me to just try Ammonium Sulphate for my cane and let him know the result. Thereupon, I obtained from him 14 lbs. of Ammonium Sulphate and applied it to a part of my cane fields which had not received *Honge* or other oil-cakes. In about 15 or 20 days after the application of the salt I began to realize its good effect on my crop. The crop which was looking quite pale and stunted, put on green colour and began to look healthy. Furthermore, even the canes which we had rejected as dead, started to grow vigorously with the help of this small dose of the salt. I was tempted to purchase a small quantity of this manure for my next crop. Another point I observed was that sugar or jaggery which I made from canes which had received Ammonium Sulphate looked whiter in colour than those which I made from canes which had received *Honge* or other oil-cakes. This experience strengthened my desire to further try the salt with the result that during the present season I and other ryots

of my village have purchased 350lbs. of Ammonium Sulphate and applied the whole quantity to our crop. The growth of canes has been remarkable as usual and the ryots who have not used this manure are pleased with my crop and have decided to purchase the manure for their next crop. I hope our Agricultural Department will continue to introduce such profitable improvements as this and deserve the gratefulness of the ryots.—*M. Rama Reddy, Member, District Board, and Representative Assembly, Bowringpet Taluk, Kolar District.*

C

The Effect of Ammonium Sulphate on Sugar-cane.

I used to make frequent enquiries of the Agricultural Inspector, Kolar, if the Agricultural Department, as the result of their experience, had found out some good manures and irrigation appliances useful to crops like potato and sugar-cane. The Agricultural Inspector, Kolar, told me that a manure called Ammonium Sulphate shows indications of being beneficial to sugar-cane and suggested that I might try it on a small plot of my cane field. Further encouraged by the experience of Mr. M. Rama Reddy, District Board Member, Bowringpet, and Mr. Venkatasamy Gowda of Santhehally, Malur Taluk, I applied Ammonium Sulphate to a quarter of my crop which, by circumstances, had not received *Honge* oil-cake. The other three quarters had been manured with *Honge* cake. Canes on the plot which had received oil-cake were looking dark green and vigorous, and the plot which had not received oil-cake, though adjacent to the other, was looking as if it were a different garden altogether.

I tried Ammonium Sulphate on this neglected plot and applied 75lbs. of the salt for 2,800 seed area of the cane. The plot was profusely irrigated and in about 20 days after the application, the crop changed colour and just now this crop is as good as on the other oil-cake plot. It is my opinion that Ammonium Sulphate is very useful to sugar-cane.—*L. Vema Reddy, Landlord, and Vice-President, Taluk Board, Malur.*

III

Spraying for Plant Lice.

Mr. Chikkegowda, Patel, Shravandahally, Maddagiri Taluk, writes to the Director of Agriculture in Mysore as follows :—

Tobacco is very commonly grown in these parts. The tobacco leaf is subject to attack by three kinds of insects in these parts. The practice in these parts is to dust the leaves with wood ashes or fine lime powder, but the insects are affected only very slightly by this method.

The three insect pests are :—

1. An insect as big as the Kondali Hula of castor.
2. An insect resembling the locust but not so big as the locust. These two insects eat the leaves.
3. Another kind of minute insects (Plant Lice) which increase by thousands every day. These suck the juice from the leaf and ultimately the plant dies. They are numerous in some years, and some years they are not found at all.

I do not understand how they arise at all. After an attack by these minute insects, if there is a shower of rain or if the weather is damp, the attack assumes a serious form. When the sun is very hot, the attack is sometimes reduced. The attack is when the plants are about 2 months old and not later.

I have grown 10 acres of tobacco this year. There was much attack by the third kind of insect on about 6 acres of my crop. When the Deputy Director visited my place sometime ago, he promised to arrange to send an officer of your Department with drugs, appliances and all to treat my crop. An officer visited my place with a sprayer and some stuff. We made a decoction from pieces of tobacco leaf which we reject while preparing the tobacco for the market and mixed with it some fresh lime and sprayed the whole crop with this liquid. In about 4 or 5 days after spraying, the insects died and the leaves regained the proper colour. The liquid did no damage to the leaves at all. The insects died in spite of there being small showers of rain while the crop was being sprayed.

This remedy has saved me thousands of rupees and I am grateful to you for this simple remedy which you have found out to destroy the pest.

NOTES AND COMMENTS.

By the Editor.

The Menace of Synthetic Indigo again.

The latest English newspapers contain accounts of the rapid revival of the German dyestuffs trade and of the organized attempt to capture the markets in which Germany ruled all-powerful before the war. Despite anti-dumping legislation, heavy import duties and the severe and crippling handicap imposed by the terms of the Peace Treaty, German dyes are, it is stated, penetrating into Great Britain and France; and no doubt before long the invasion of the Indian market will commence with results not difficult to foresee. During the period of the war and after, the Indian natural indigo market has been very remunerative: the cultivation of indigo was taken up even in our State in different places as a consequence. Prices even now are by no means discouraging and the cultivation will certainly continue; it is, however, doubtful if, after the stimulus of the high price is taken away, the newly started industry will survive. The value of the indigo crop as a renovating and manurial crop in addition to being a commercial crop will always count in its favour and this fact will enable it to stand a great deal of competition. We hope such among our raiyats as have commenced the cultivation of indigo newly during the last few years will bear this fact in mind.

* * * * * *

The "Cletrac" Tractor.

It is certainly gratifying to be able to note that quite a number of Agricultural tractors have come into use in our State within the short space of a year or so since when these machines began to be imported into India. There is no doubt the convenience of the tractor as against bullocks for agricultural work is being appreciated. The fact of its handy construction and comparatively low cost are also in its favour as against the large power ploughing outfits like the Fowler's Double Engine outfit, which, though in use for some years just across our border in the Dharwar district, have failed to

excite sufficient interest for any to be bought by landholders in our State.

On the other hand quite within a short period there have been imported into the State at least ten tractors with their ploughing and cultivating tackle. The "Fordson" and the "Austin" have so far monopolised the field. Experience with either of these types has not been uniformly favourable to "Tractor" work; while some users have had exceedingly satisfactory work turned out, others have had very bad luck. Nevertheless tractor work continues to appeal. Recently we have had occasion to inspect the work of the "Cletrac" Tractor in one of the large Estates near Periyapatna. This tractor is of the 'Caterpillar' type unlike the "Fordson" or the "Austin." It was ploughing with a three disc plough, with discs 18" in diameter. The soil was a light loam, in excellent condition for ploughing. The ploughing was being done in great form; about 8" was the depth of the ploughing: the machine could move with great ease on ploughed ground, take a turn within a very narrow sweep, could climb and tear up the dividing bunds of fields, and all without any noticeable strain. Till the time of our visit the outfit had ploughed 80 acres within 14 days, there having been some little break now and then when there was wet weather. For ploughing these 80 acres, 36 tins (each of 4 gallons) of kerosine oil had been used; likewise $1\frac{1}{2}$ gallons of petrol and 4 gallons of lubricating oil. The discs had needed no changing, in fact they did not seem to have worn much at all. This is certainly very satisfactory work. We were given to understand that the Agents, Messrs. Best & Co., of Madras, were prepared to plough up land for applicants with this outfit charging Rs. 10 per acre.

* * * * * *

The Indian Sugar Industry and the Central Government.

The Indian Sugar Industry has a most enthusiastic champion in the person of Sirdar Jogendra Singh in the Council of State. The Sirdar is one of those who would not let the grass grow under their feet; hardly in fact had the report of the Indian Sugar Committee been published before the Sirdar, who, it will be remembered, was himself a member of that Committee, tabled a resolution in the Council with a view to giving effect to the recommendations of the Committee. He pleaded for action being taken at once, previous consultation

with local Governments being dispensed with in order to avoid delay ; and for the fostering of the Industry (*a*) by providing compact blocks of land for sugar-cane cultivation in all districts where 50,000 acres are already under cane, (*b*) by providing compact blocks from waste and forest lands, etc., and (*c*) by guarantees of interest on the capital raised for the establishment of sugar factories.

Much as the members were in sympathy with the objects of the mover, none of the specific provisions of the resolutions received any support. Agriculture being a "transferred" subject, it was pointed out that only the local Governments could take action on the recommendations of the Committee's report and even such action as the Central Government may take could be only in consultation with the local Governments. The matter of the securing and grant of compact blocks of land and the guaranteeing of interest were also considered difficult, if not impossible. The Government however stated that they fully recognized the importance of fostering the Industry and as the report was under the consideration of the Government, an amended resolution of an absolutely unexceptionable nature in its non-committal and pious sentiments was passed. This resolution runs as follows : That in so far as the recommendations contained in the report of the Sugar Committee suggest action by the Central Government, such action be not delayed and that as far as possible effect be given to the recommendations of the Sugar Committee's report as early as possible and the Government should foster the Sugar Industry."

* * * * * *

The Promotion of Cotton-growing in the British Empire.

The British Government is assisting the Empire Cotton-growing Corporation with a capital grant of £ 1,000,000 which amount is stated to be one-fourth of the total profits made by the British and Egyptian Governments from their joint control of the cotton supply during the war. The Corporation receives in addition the proceeds of a voluntary levy by the cotton industry in England of 6*d*. on every bale of cotton imported into England.

The Corporation is, among other things, awarding twelve studentships of the annual value of £ 200 for the training of graduates in scientific research bearing on the various aspects of tropical Agriculture.

* * * * * *

Delinting Cotton Seed.

We read that machinery has been perfected for the purpose of removing the fluff from cotton seed after the seed is ginned in the usual way, without injury to the seed or the fluff. The latter after removal in this manner is said to make excellent paper-making material. From the point of view of the requirements of cattle feed or cotton seed oil and cake, this fluff or residual lint is a serious drawback, so that this new process of delinting will have the double advantage of not only manufacturing a new paper material but of making cotton seed more suitable for its present uses. It will of course be specially advantageous in the case of the Dharwar American, Cambodia and other forms of the American Upland varieties which do not gin clean but retain much adhering fluff and which are for that reason not as popular cattle feed as the local varieties.

* * * * * *

The Coconut Beetle again.

Yet another remedy for the Rhinoceros Beetle is mentioned in the report of the Deputy Director of Agriculture, Konkan Division, Bombay. The oil of the Cashew-nut is said to repel the beetle and the method of applying the remedy is described thus :—

"Some cotton rags are to be dipped in the oil and to be kept on the topmost part of the tree in the crown or the axil of the bunch. One pint bottle is sufficient for 100 trees." The results are said to have been encouraging.

* * * * * *

Boring and Pumping Machinery.

In the report of the Bombay Department of Agriculture for the past year, we read with considerable interest of the work relating to the putting down of borcholes and pumping installations by the Agricultural Engineer. The number of bores during the year totals close on 200, which is certainly a large number. Some of the depths reached are also striking, the deepest bore being 240 feet ; 56 per cent of the holes have been classed as successful and among the remainder some are classed as unsuccessful and some are incomplete. This is by no means a poor record especially when the difficulties regarding all classes of machinery

in recent years are taken into account. But what is a "Success" when that term is applied to such installations ? In view of the complaints regarding some of the irrigation pumping plants in our own State that one sometimes hears, the following remarks by Mr. Keatinge, Director of Agriculture by way of answer will be found very appropriate. The Director states, "It is uphill work for the Agricultural Engineer to ensure that the pumping plants he erects for individuals shall be a success. The pump owner usually depends on the Agricultural Engineer for years together to run his plant and to be responsible for the smallest repairs. Even when the plant can be made a mechanical success, it is liable to be a financial failure because it remains only half used or because the cultivation is bad. I fear that we have not yet got to the stage when we can push such machinery amongst average cultivators simply on the ground that physical conditions are suitable. It is necessary in addition that the man who owns the plant should be a man of enterprise, energy and means. It is not easy to find this combination." These are true words no doubt and deserve to be taken serious note of. At the same time we believe that the sense of such failures as may have happened should not materially affect the attitude of the department in encouraging progress in this important matter. The provision of irrigation water in our country is the most valuable service which any department of the State can render to the agriculturist. In an ancient country like India practically all that can be done in the matter of using above-ground supplies has been done in the past ; even as regards underground supplies all that could be tapped and raised by the means at the command of the raiyat has been done. In more advanced methods of lifting and in tapping deeper sources of supply alone can we find any further scope for work in this most vitally important matter.

An over-eager officer, driven perhaps by a desire to show quick results, may have in a few cases exceeded the bounds of prudence and pushed such plants into places where the conditions may not have been all that may be desired and into the hands of the "average" cultivator. But the average cultivator will always remain with us and in the large majority also and the movement should certainly not receive a set back on that account. The present types of pumping plants do not certainly constitute the last word in the matter of their

suitability to the conditions here ; nor do we think indeed that even the various other types that are at present known to us have been tried. There is plenty to do on the part of the department itself, but what we should like to emphasise is that enthusiasm in this subject should not cool down.

* * * * * *

The Water Hyacinth.

This noxious weed has evidently assumed such serious proportions in Bengal that the Government has deemed it necessary to appoint a strong Committee to study and suggest suitable measures for its eradication. The Committee is presided over by Sir Jagadish Chandra Bose and among its members are representatives of the Agricultural and Engineering departments. In Madras the Department of Agriculture sounded a note of warning quite a long time ago and we are personally aware that certain municipalities in the South Indian districts have had to spend considerable amounts of money to keep tanks and channels cleared of the weed. In one town there was hardly a tank, pool, or excavation which was not covered with such a thick mat of this growth that one could hardly think it was a water surface. We understand many waterways are also getting invaded in this manner in those districts. Evidently in Bengal the pest is even more serious.

Even in our State the water hyacinth is not unknown and it will be wise to see that the pest is destroyed before it spreads. Years ago we remember remarking on the beauty of the flowers in the garden of one of the residents in Bangalore who was growing it in pots for the sake of its pretty flowers ; to-day it could be seen in several ponds and water surfaces within the limits of Bangalore as well as in more than one such situation in the districts. The Bangalore City Municipality is, we understand, keeping a keen watch in the matter with a view to destroying it wherever found ; it will be well that other stations follow suit.

SELECTIONS.

I

Shelter or wind break for Bananas.

The value of shelter from southerly and westerly winds cannot be too strongly stressed, for it is a most important factor in the future productivity and permanence of a plantation. Too little attention is given to shelter; bananas are sometimes planted on exposed hill sides and consequently only moderate results are obtained, and the reason is not far to seek.

Almost the whole of the banana plant is composed of leaf matter. The broad undivided leaf of the plant shows that its natural habitat must have been in sheltered regions, where the leaves would be protected from boisterous winds. Hence it may be inferred that a windy situation is not suitable if large bunches and well developed fruit are desired. The function of the leaf is to obtain from the atmosphere food for the growth of the plant, the motive power for the work of manufacturing the food being obtained from the rays of the sun by means of the green colouring matter (chlorophyll). The water absorbed by the roots, together with the mineral plant foods in solution, is carried to the leaves, and there with the carbonic acid gas of the air, the various organic compounds are elaborated by the plant. The compounds so manufactured are then transferred, and used where required or are stored up in the bulb for future use.

This consideration of the importance of leaf functions shows sufficiently that heavy winds, by cutting the leaves into ribbons, interfere with the manufacture of food. Shelter is therefore necessary for the proper feeding of the plant: in fact, given good shelter a grower will get better returns from soil that is not so good than from better soil exposed to either westerly or southerly winds. For banana-growing purposes, good shelter increases the land at least 50 per cent., that is to say, land with good shelter is worth twice as much as similar land which is exposed to prevailing winds. Indeed, the chances of success without adequate shelter are remote.—*Agricultural Gazette of N. S. W. for August*, 1921.

II

The Systems under which Sugar Factories in Cuba purchase Sugar-cane from growers.

As it is essential that a sugar factory depending upon independent cultivators for the supply of cane should pay a fair price based on the economic law of supply and demand, it will serve a useful purpose to know the system followed in Cuba.

Canes are bought by the factory in Cuba by weight, on the valuation of a fixed percentage of sugar at current rates. If, for instance, the sugar is worth £ 20 a ton f. o. b. the farmer would receive £ 1 a ton for his canes. According to the *West India Committee Circular* the terms in Cuba vary from 5 to 6 per cent of the cane, mainly 5 per cent and 5½ per cent due to differences in local conditions. The only stipulations on the part of the factory are that the canes should be fresh and "clean", and on the part of the farmers that no favouritism should be shown in the time of taking over the canes.

This method has worked perfectly well under ordinary conditions, but at the time of the boom, mills which had sold sugar forward at 7 cents were forced to settle on a basis of something like 20 cents owing to the rise in the world price of sugar due to speculation, which had the effect of turning what looked like a very prosperous season's working for the mill into a dead loss. It seems therefore that the perfect system should have an additional clause limiting the price to 5 per cent of the actual price obtained by the mill for its sugar, and the world figure should not be allowed to enter into the contract at all, as it is evident that the mill is out to get the best figure possible for its sugar, and it should not be possible for the mill to gamble, though of course under such circumstances it would be necessary for the mill to hold a "contract to deliver cane" from its colonies to avoid all cane going to the mill which had sold at the highest rates.

In India factories purchase cane by weight and pay a fixed price per maund. Annas four to five per maund in Bihar was the usual rate before the war for cane delivered at the factory or the nearest Railway Station. But with the rise in the price of sugar the price of cane also rose, and from annas nine to even annas twelve were offered last year. At this rate of payment sugar-cane pays handsomely in comparison with other crops in Bihar. Recently in Bihar a factory has made arrangements with the cane growers for payment on a sliding scale based on half the average price obtained by the mill for its sugar which is in

my opinion an improvement on the Cuba system, as the growers have a contract with the Factory.—*By the Secretary, Sugar Bureau, Pusa, in the Indian Trade Journal.*

III

Distance in planting Cotton.

Some results of tests in thick spacing of cotton as opposed to the system of wide spacing, carried out in a number of State experiment stations in America, are said to have demonstrated the value of the thick spacing or single culture system, advocated by the United States Department for several years past. The single culture system spoken of refers, no doubt, to the single plant system all along recommended by the Imperial Department of Agriculture, and more or less generally adopted by cotton growers in the West Indies. But the tests here reported on would appear to refer to trials in which closer spacing was employed than that practised in these colonies, and which it is claimed give bigger crop returns.

For instance, it appears from results published in the *Southern Planter* for February 15, 1921, that experiments made by the Department of Agriculture some time ago, showed that cotton plants grown 3 inches apart in the row, produced a great deal more lint than when planted 3 feet apart, and that the same is true of all intermediate stages. In other words, the widest spacing is the worst system, and any narrowing of the spacing down to 3 inches is an improvement. These results are said to have been confirmed recently by experiments carried on at several State stations. The following are the results of a series of experiments reported from the Delta Experiment Station, Stoneville, Mississippi, and published in the Journal above referred to :—

	Pounds lint per plot.
Plants 8 inches apart	117
Plants 12 " "	93
Plants 16 " "	90
Plants 20 " "	59
Plants 24 " "	57
Plants 28 " "	56

Unthinned, or left as placed by the planter, average of 2 plots — 134½. When two plants were left together, at these same distances between the hills, the results were as follows :—

	Pounds lint per plot.
2 Plants in the hills, 8 inches apart	112
2 Plants in the hills, 12 „ „	109
2 Plants in the hills, 16 „ „	99
2 Plants in the hills, 20 „ „	92
2 Plants in the hills, 24 „ „	86
2 Plants in the hills, 28 „ „	71

It is explained that if cotton is grown sufficiently thick in the row, the plants put out only fruiting branches ; there is no room for the vegetative branches to grow. Therefore, more plant growth is restricted, and the vitality of the plant goes largely into lint production, with the result that the bolls are put out and mature much earlier and more profusely than when the plants are far apart. When close spacing is adopted however, as in the experiments under notice, thinning must be delayed until comparatively late in the season.—*The Agricultural News, Vol. XX, No.* 493.

IV

The Rhinoceros or Black Beetle (*Oryctes rhinoceros*)

The Rhinoceros or Black Beetle (*Oryctes rhinoceros*) is very numerous at the present time, especially in the grub stage. The grubs or larvæ breed very freely in dead stumps of coconut and palmyra palms, and there are hundreds of such stumps scattered throughout the Batticaloa District at the present time, chiefly on neglected or partially abandoned estates and in villagers' compounds.

In the case of this pest, it is the beetle stage which does the damage by boring into the crowns of trees and feeding on the sap. Unless such holes are plugged up, they serve as sources of infestation for the Red Weevil, the grubs of which bore down into the stems.

The "Black Beetle" grubs do not damage living palms, but feed only on decaying vegetable refuse, such as rotting stems lying on the ground, dead stumps, rubbish heaps and heaps of animal manure.

Control Measures.

(*For the Grubs*)

1. Cut down all dead palms at ground level and cover the stumps with 8 inches depth of sand.

2. Treat all dead stumps in a similar way, and then clean out the cavities in the roots, being careful to destroy all grubs immediately. Then fill in the cavities with sand and cover with an 8 inch layer of sand 1 and 2 are the most important measures at the present time.

3. Cut off and burn the tops of all fallen coconut and palmyra palms. The stems can be cut into convenient lengths and used for building purposes, provided that the ends are protected from the action of weather.

4. Unsplit coconut logs used for fence and gate posts and for bridges must only be so employed temporarily and must be renewed every twelve months, as they are liable to decay after some months' exposure to the weather. There is no objection to using split logs for fences, posts, etc.

5. Split and burn all decayed coconut stems taking care to destroy the contained grubs. The disposal of such stems should be a simple matter as most of them are in an advanced state of decay.

(*For the Beetle*).

1. Probe the holes in the crowns of trees with a slender sharp pointed barbed iron to kill and extract the beetles.

2. Fill up the holes with a mixture of one part coarse salt and 2 parts sand and plug with clay where practicable.

This measure against the beetle is of little use unless the breeding places of the grubs are dealt with at the same time.

The Red Weevil (*Rhynchophorus ferrugineus*).—This is a more dangerous pest of coconuts than the "Black Beetle," since the grubs are capable of killing palms by tunnelling in the stems. The weevil is attracted to lay its eggs in any wounds or injury to trees, and the grubs breed very rapidly often without their presence being detected until the tree begins to die. Young trees are much more liable to attack than old ones.

Control Measures.

1. Cut off and burn the tops of fallen trees and dispose of the stems as for Black Beetle.

2. Cut down all the badly damaged young palms to ground level and treat the stumps as above. Dispose of the stems as above.

3. Avoid all artificial injury to palms, such as stripping of leaves, injury by estate carts, wounds from knives, etc. Leaves should be cut off and the ends tarred (where removal is for coconut caterpillar) or should be allowed to fall naturally. All wounds should be tarred over.

4. In lands which are periodically flooded or where trees have not been planted deeply enough, cover up the exposed roots and base

of the trees with soil and surround trees with a barrier. Both the beetles are declared pests, but very little action seems to be taken to control them.

A general measure for the two beetles is to keep an estate in a clean, sanitary condition, and the trees as vigorous as possible.—*The Tropical Agriculturist, Vol. LVII, No. 2.*

V

The Poling of the Agaves.

As the Fibre-Agaves, in common with almost all species of Agave, grow vegetatively for a number of years, producing only leaves and then flowering and dying, the two main factors on which the yield depends are, firstly, the period required for the leaves to reach a condition of maturity, and secondly, the period intervening between this and poling. The longevity of the plant, and therefore the number of years throughout which the crop can be secured, is of course decided by the number of years the plant passes in the purely vegetative state before poling and dying. Premature poling is therefore liable to tender the cultivation of Fibre-Agaves impossible, for the planter must recover all the capital expended in their cultivation in a relatively short period.

There is seemingly a marked paucity of reliable information in regard to the age in which these plants flower. It does not appear to have occurred to any individual or organization, to conduct a series of experiments to determine the reasons responsible for the great fluctuations in the period required for the initiation of poling. The life period of Agaves in northern latitudes may vary from ten to fifty years or more. On account of this exceptional longevity in succulent plants, they are sometimes called Century plants. In the Tropics, grown under natural conditions, these plants seldom last longer than seven to twelve or fifteen years. Some recent work of Garnar and Allard, on the effect of relative length of day and night on growth and reproduction, leaves little room for doubt that these marked fluctuations in the length of time that elapses previous to flowering in Agave plants in northern latitudes, and in the tropics, may be due in a large measure to the differences in the daily periods of daylight in the two regions. Even in the Tropics, however, the differences in the length of the life-cycle are sufficiently pronounced to determine whether the cultivation of Fibre Agaves can be profitably entered upon, or the reverse. As the information bearing on this subject is somewhat anecdotal in nature, any conclusion which may be drawn,

must be received with extreme caution. It may not be out of place at this stage to point out, that the tendency to a prolonged vegetative period manifested by the Agaves, though an inherited characteristic, can only come into expression under definite conditions of the environment. It has frequently been held in part, that the periodicity exhibited by plants in initiating sexual reproduction was due to an inherent rhythm, which is independent of the physical environment. That only the tendency is heritable, and that a particular complex of conditions is needed for its expression, appears to be the case in Agaves, if not in all plants. This is evidenced in the first place by the differences exhibited in the longevity of the plants, which is dependent on the period required for the initiation of sexual reproduction in the Tropics, and in northern regions.

The factors responsible for the differences in longevity exhibited by the Fibre-Agaves may now be considered in so far as the data available will permit. The first question is whether there are any genetic different species and varieties in this respect. In the absence of experiment, no definite answer can naturally be expected. According to Trelease, *Agave fourcroydes*, Lemaire, which is generally termed Henequen, and is cultivated extensively in Yucatan, has a life of ten to twenty-five years. *Agave sisalana*, Perrine, which is known usually as Sisal, and is cultivated among other places in the Bahamas, has a life of only five to ten years. *Agave cantala* of the Philippines, has also a life-cycle of only five to ten years. It would appear that Henequen has, on the whole, the greatest longevity of the more important Fibre-Agaves. Concerning the effect of cultural treatment on premature poling, there is a fair uniformity of opinion in the different regions where the Fibre-Agaves are cultivated. If the root-suckers, which are abundantly thrown out around the base, are allowed to remain attached for a long period, or if the young leaves are cut, poling is accelerated. The physiological interpretation of this is naturally obscure. There is, however, some evidence that the initiation of the reproductive phase in the life-history in plants is intimately associated with the carbohydrate-nitrogen balance. Removal of the young leaves and failure to remove the suckers may evidently upset this delicate balance and initiate poling. Much of the difficulty experienced with premature poling is doubtless due to an inadequate appreciation of the importance of this aspect of the subject.

Of peculiar interest is an experiment which was commenced in Montserrat in 1902. The sisal was propagated by bulbils in September. In two years it was ready for reaping, whereas the normal period before the leaves are ready is from three to four years. In 1907,

25 per cent of the plants had poled. The points of interest are the early maturity of the leaves and the premature poling: the whole life cycle appeared to be accelerated; four good crops had, however, been secured before the plants were dug out, owing to the non-arrival of the fibre machinery. The Fibre-Agaves are frequently held to be calcicolous plants requiring the presence of calcium for their best development; it seems probable, however, that it is the conditions which accompany the existence of calcium in a soil rather than its presence, that are essential. Low or swampy lands, in which aeration is inadequate, and where organic acids are liable to accumulate, are said to be unsuitable. A long dry season and a short rainy one are considered essential for the best growth; but sisal apparently grows luxuriantly in a rich soil and a wet climate, though quality and yield of fibre is not at its best. There is little evidence to show what is the exact effect of soil conditions or rainfall on premature poling. It is sometimes stated that propagation by means of bulbils instead of suckers is responsible for premature poling. The evidence, however, is conflicting on this point. The need for experimentation in order to elucidate the factors responsible for premature poling is very necessary, in view both of the scientific interest and the economic importance of the subject.—*Agricultural News, Vol. XX, No.* 493.

VI

Sugar Factories established on Modern Lines in India.

The Sugar Bureau maintains a complete and up-to-date list of all modern sugar factories working in India and is in touch with each of them. A list of these factories is given below. In the list, factories have been divided into three classes according as they are :—

1. Factories making sugar direct from the cane.
2. Factories working as refineries and also manufacturing sugar from cane.
3. Factories refining cane or palm jaggery or rab.

It should be noted that the list does not include factories working according to the indigenous process of refining, that is to say, those factories which do not use the modern process of sugar making or refining.

FACTORIES WORKING WITH CANE ALONE.

1. Japaha Sugar Factory, Japaha, District Muzaffarpur.
2. Factory of the Champaran Sugar Co., Ltd., Chakia, District Champaran. (Managing Agents: Messrs. Begg Southerland & Co., Cawnpore.)

3. Factory of Ryam Sugar & Co., Ltd., Ryam, District Darbhanga. (Managing Agents : Messrs. Begg Southerland & Co., Cawnpore.)
4. Pursa Sugar Factory, Pursa, P. O. Lauriya, District Champaran.

United Provinces.

1. United Provinces Sugar Factory, Bubnowlie, District Gorakhpur.
2. Partabpore Sugar Factory, Chupra Duboulie, District Gorakhpur. (Managing Agents : Messrs. Begg Southerland & Co., Cawnpore.)
3. Gauri Sugar Factory, Gauri, District Gorakhpur. (Managing Agents : Messrs. Begg Southerland & Co., Cawnpore.) (*Not working*).

Madras.

1. Aska Sugar Factory, Aska, District Ganjam.

Punjab.

1. Punjab Sugar Works, Sujanpur, District Gurdaspur. (*Not working*).

Assam.

1. Factory of the Assam Sugar Estates and Factories, Ltd., Kamrup, Assam. (Managing Agents : Messrs. Bird & Co., Calcutta.)

FACTORIES THAT MAKE WHITE SUGAR FROM CANE AND ALSO WORK AS REFINERIES.

Bihar and Orissa.

1. Supaul Sugar Factory of the Bihar Sugar Co., P. O. Supaul, District Bhagalpur. (Managing Agents : Messrs. Octavius Steel Co., Calcutta.)
2. Manhaurah Factory of the Cawnpore Sugar Works, Ltd., Manhourah, District Saran. (Managing Agents : Messrs. Begg Southerland Co., Cawnpore.)
3. Lohat Sugar Factory of the Darbhanga Sugar Co., Ltd., Lohat, District Darbhanga. (Managing Agents : Messrs. Octavius Steel Co., Calcutta.)
4. New Sivan Sugar Factory, Sivan, District Chapra. (Managing Agents : Messrs Kilburn & Co., Calcutta.)
5. Factory of the Samastipur Central Sugar Co., P. O. Samastipur, District Darbhanga. (Managing Agents : Messrs. Begg Southerland & Co., Cawnpore.)

United Provinces.

1. Rosa Factory, Rosa, District Shahjehanpur. (Managing Agents : Messrs. Carew & Co., Rosa.)
2. L. Hl. Brothers' Sugar Factory, Pilibhit, District Pilibhit.
3. Saraya Sugar Factory, P. O. Chauri, Chaura, District Gorakhpur.

MADRAS.

1. Samalkota Factory of the Deccan Sugar and Abkari Co., Ltd., Samalkota, District Godavari. (Managing Agents: Messrs. Parry & Co., Madras.)
2. Nellikuppam Factory, Nellikuppam, District South Arcot. (Managing Agents: Messrs. Parry & Co., Madras.)

BARODA STATE.

1. The Sugar and Gur Refining Factory, Gandevi, District Surat. (*Not working.*)

MYSORE STATE.

1. The New Pioneer Sugar Mills, Goribidnur. (Managing Agents: Messrs. T. Wilberforce & Co., Calcutta.)

FACTORIES WORKING WITH RAW SUGAR ALONE.

BIHAR AND ORISSA.

1. Sivan Deshi Sugar Factory, Sivan, District Saran.

UNITED PROVINCES.

1. Tribeni Deshi Sugar Works, Naini, District Allahabad.
2. Union Indian Sugar Mills, Ltd., Nawabganj, Cawnpore.
3. Cawnpore Factory of the Cawnpore Sugar Works, Ltd. (Managing Agents: Messrs. Begg Southerland & Co., Cawnpore.)
4. Pioneer Sugar Mills, Ltd., Unao, District Unao. (Managing Agents: Messrs. T. Wilberforce & Co., Calcutta.)
5. Baijnath Balmukund Sugar Factory, Anwarganj, Cawnpore.

MADRAS.

1. Kulashekharapatnam Factory, Kulashekharapatnam, District Tinnevelly. (Managing Agents: Messrs. Parry & Co., Madras.)
2. A. R. & R. Sugar Mills, Tachanallur, District Tinnevelly.

BENGAL.

1. Cossipore Sugar Works, Ltd. (Managing Agents: Messrs. Turner Morrison & Co., Cossipore.)

PUNJAB.

1. Harkshun Sugar Mill, Amritsar.

By the Secretary, Sugar Bureau, Pusa, in the Indian Trade Journal.

VII

Some Practical Hints on the Management of Orchards in India.

The interesting and useful article on "Woolly Aphis" or the "American Blight," contributed by Mr. C. S. Misra. B.A., First Assistant to

the Imperial Entomologist, in the November (1920) issue of "The Agricultural Journal of India," together with the valuable note of the Imperial Entomologist, has tempted me to suggest a few practical hints on the successful management of orchards in India.

It is indeed painful to observe that this serious insect pest the "Woolly Aphis," first noticed in this country sometime in 1889, should have spread so rapidly and virulently as to become an object of alarm in most of the apple-growing districts in India. This, I believe, is due partly to ignorance and partly to negligence on the part of our Indian fruit growers, and a few practical hints, therefore, may be of some service to the owners of orchards in India.

The first important thing that a fruit-grower has to bear in mind is to keep his orchard always clean, that is to say, he should see that it is free from rubbish, weeds, clumsy grasses, untidy hedges or fences, surface drains full of fallen leaves, dead twigs, etc., which offer secure shelter to insect pests of various sorts. Cleanliness, clean cultivation, is the essence of success in all horticultural business, and especially that of the fruit grower. Keeping orchards continually clean should have a great value to the entomologist who desires to prevent the spread of insect pests in orchards. Cleanliness may not have direct remedial values, but is surely a precaution against further growth and development of many of the formidable insect pests found so often in orchards, by eliminating their possible lurking places, where they hatch innumerable offspring, and whence they are ready to emerge at any time. Again, there are certain night-feeding forms, which must needs seek shelter for security during daylight, and their onslaughts may be minimized and kept under control, if their hiding places are permanently destroyed. *Constant* pests like "Woolly Aphis," the "Apple Sucker" or the "Codling Moth" may be got rid of or kept within control by taking direct vigorous measures against them: but there are numerous *occasional* pests which, although far less important individually, occur sporadically and irregularly on fruit trees, which by their total effect cause a serious loss to the crop. It is impossible to take any direct measures against each casual pest, since one never knows when they will occur, or whether they will occur, but something can be done indirectly to discourage their activities in an orchard by keeping it continually clean, thereby destroying all possible sources of their hiding places, where they multiply daily in large numbers.

The second important point that a fruit-grower has to note is a careful and intelligent pruning. I say *correct and intelligent*, as I have

seen hundreds of instances of very bad prunings at the hands of our inexperienced and illiterate Indian *mālis* and workmen, who think that they are masters in horticulture, and can do all with a pair of shears once a year! Such reckless pruning would be even worse than no pruning at all, and should be discouraged everywhere.

While no hard-and-fast rules can be laid down for a correct pruning, it is safe to suggest the few following hints, which are applicable generally to all trees in an Indian orchard for their good and beneficial effects :—

1. Immediately the fruiting season is over, cut off, every year, all dried and weak stems, especially those which appear sick and diseased. By this mode the trees are much improved and stimulated, and often encouraged to send forth new and healthy shoots with greater vigour and rapidity.

2. All barren trees in an orchard which have failed to produce fruits for a number of years require severe pruning, by cutting them hard back, retaining only the most vigorous and healthy branches. For the next two successive seasons, they should be left undisturbed, removing only the dried and decayed stems, if any.

3. The pruning should always be made with the aid of some *sharp* implement. Never use *blunt* shears or secateurs. The long handled tree pruners, which are made in various lengths, are unquestionably the most simple and useful implements in an orchard for pruning branches that are out of your arm's reach. For big and old branches, a pruning-saw is another very necessary tool, where pruning-shears or secateurs are not strong enough.

4. The cuts made by pruning should be as smooth as possible. For this reason two or three chisels of different widths should be kept in an orchard for paring the surface of any branch that has been cut with a saw, for a smooth surface soon heals over, whereas a rough one holds moisture, which frequently means the beginning of decay, and through such cuts fungi may enter the tissue of the plant. For this reason it is a wise precaution to paint over with coal-tar all cut surfaces in trees of more than an inch in diameter.

5. Never prune strong and healthy branches of an already fruit-bearing tree, as by doing this you will not only retard their progress of growth, but have every chance of doing substantial and permanent damage to the plant.

The next item for consideration to a successful fruit-grower is to provide a due and adequate supply of light and air in his orchard. A good and wholesome air with enough of sunlight and rain is equally necessary to keep the plants healthy and free from insect pests. For

this reason, your fences should be as open as possible and practicable. Ideal woven wire fences, as advertised by Messrs. Burn & Co., are most suitable for all agricultural purposes and should be invaluable for the fruit-grower. If there must be hedges, let them be as open as possible, especially below. Of course, they should be sufficiently thick to be cattle-proof and protective against thieves, yet there should be enough opening to admit a free circulation of air in orchards.

Over-crowding of trees in an orchard is another drawback to getting a produce of perfect marketable fruits without blemish. Every orchard should be started on the basis of this fundamental principle, by planting the trees at such distances as will prevent overcrowding on their attaining full growth. In old orchards, where trees are found to be too thickly planted and none producing perfect crops, they should be thinned out at intervals.

The fourth important thing for a modern successful fruit-growing business is the elimination of the grass-growing business completely from an orchard. The tillage of the soil under fruit-trees and between the trees has a great influence in keeping down pests. Where the fruit of an orchard is not the first necessity, grass may be grown under the trees; but if the orchard is primarily for fruit of the perfect kind that sells well or stores well, permanent grass is a great mistake. Insect pests of various kinds coming from the tree find a secure shelter at the surface of the soil among grass stems; some go deeper and get into the soil. Many caterpillars, in the intervals of feeding, shelter themselves amongst the grass around the trees, and some, when about to pupate, go deeper and penetrate in the soil. If there be no grass, they may be easily turned out and killed by tillage. But permanent grass prevents this from being done.

The last though not the least important thing for a fruit-grower is to have in his orchard always an adequate supply of suitable insecticides by which his trees are to be sprayed at regular intervals. Among the valuable insecticides may be mentioned tobacco solution, kerosine oil emulsion, lead chromate and various contact poisons. Of all these insecticides, lead chromate is of first rate importance in an orchard. For, lead chromate, properly made up, is a wash that remains on the foliage the whole year that makes it distasteful to all biting insects, *e. g.*, caterpillars, saw-flies, weevils, etc. It is a protective wash, and has a special value in keeping the foliage fruit-trees immune from all this class of attack. To compose this valuable insecticide, you are required to add some soap, as simply lead chromate and water will not "wet" the leaves of trees. If one part of lead chromate be mixed with 1,500 parts of

water and some quantity of soap added just necessary to "wet" the leaves, it will probably make one of the most valuable insecticides for an orchard.

If a fruit-grower be cautious from the beginning, having, so to speak, a nightmare vision of an orchard as a place full of lurking insects ready to leap out of their hiding places at any time, if he would take enough care to keep the environment continually clean, to keep his plants always neat by careful sprayings, to give all the good of the soil, all the sunlight and rain to his plants, to avoid overcrowding, and to grow what he actually wants and nothing else, I am sure such dreadful insect pests like "Woolly Aphis" can never possibly take such a firm footing as ha been sadly experienced by growers, but can be successfully kept under control without much trouble or expenditure.—*Agricultural Journal of India, Vol. XVI, Part V.*

VIII

Hæmorrhagic Septicæmia —a serious contagious disease of cattle.

This is another very important contagious disease of cattle in this Presidency, for it is probably the cause of more deaths among them than any other complaint except Rinderpest.

Owing to the way in which it usually affects cattle in this country it is often called 'Malignant Sore Throat,' and because it appears to attack buffaloes more frequently than ordinary cattle it used to be called 'Buffalo disease' in Europe.

In addition to buffaloes and cattle, this disease also attacks flocks of sheep, herds of wild deer, and cases have occurred in the horse and the elephant. As far as we know it never occurs in Man. There is no doubt that in the past many cases of this disease in cattle have been mistaken for other diseases, particularly Anthrax, which it is often very like, and endeavours will therefore be made in this leaflet to explain how it can be distinguished from them.

The micro-organism which causes Hæmorrhagic Septicæmia lives naturally in the soil, particularly in damp marshy places, around tanks, and in land which is not properly drained, and the disease is therefore more likely to occur after rain, when the soil is softer than usual and more easily churned up by animals walking on it.

The organism is usually taken into the animal's mouth on the grass or in the water when feeding or drinking in such places, and it gets into the blood through wounds inside the mouth, or in the gullet, stomach or gut. These wounds may be old ones which exist there, or caused

at the time of taking in the poison by eating a piece of hard prickly forage, or they may be the result of such things as shedding of the teeth in young animals.

As the animal's throat is the part which is usually most severely affected in cattle, it is thought that the organism generally enters by wounds in that part.

It is also believed that infection may take place through wounds in an animal's feet or legs, or be conveyed from a diseased animal to a healthy one by biting insects. Young animals seem to be more often attacked than old ones, and this may be due to the fact that young ones are more likely to have wounds in their mouth than old ones, or it may be that many of the older animals in a herd have had an attack when young, recovered from it, and so do not get another attack.

The poison appears to attack cattle in three different places, viz., the throat, the lungs, and the intestines.

In this country the throat form is the commonest in cattle, but it is often associated with the intestinal form, and again some animals may suffer from the combined lung and intestinal forms of the disease. This difference in the symptoms shown often makes diagnosis difficult, but an attempt will be made to describe a typical case as seen in this Presidency.

An animal is found obviously ill, disinclined to move with the herd, off feed, shivering, with a staring coat, dry hot muzzle, hurried breathing, and if a cow, will give no milk. If the temperature is taken it may be found to be as high as 108° F. A little later dribbling of saliva from the corners of the mouth may be noticed and if the animal's throat is examined it will be found to be painful.

In a few hours more alarming symptoms will be observed. The animal's throat, space between the jaws, dewlap, and sometimes even the neck and fore-limbs become considerably swollen. This swelling is hot, tense, and painful, and so is quite different to a Black-quarter swelling, which is usually confined to one of the limbs, becomes cold in the later stages and crackles when pressed with the fingers.

When the swelling of the head appears the lining membrane of the eyes, nostrils and mouth becomes dark red in colour and may have blood spots on it, the tongue also becomes very red and swollen and may hang out of the mouth, a sticky saliva constantly runs away from it, the animal is unable to swallow and may have a suffocating cough, breathing is difficult and may become so noisy as to be heard at a distance ; eventually the animal dies from suffocation. Before death it may suffer

from colicky pains showing that the poison has invaded the intestines also. It will stand up and lie down alternately, move the hind feet uneasily, groan and strain when passing fæces, which will be hard and glazed at first, but later they will become watery and may contain blood and pieces of the lining membrane of the bowels. Cases of the kind described are nearly always dead within two days, but the attack is often much shorter even than this.

It is said that some cases do not last for more than six hours and so an animal, which was healthy the previous evening, may be found dead from this disease in its stall in the morning. It is these very acute cases which are so difficult to distinguish from Anthrax, for in both diseases we may find a swelling of the throat, and a bloody discharge from the mouth and anus, after death. As it is not possible to make sure which disease it is without examining the blood under a microscope, it is best to treat the carcasses of cattle which are found dead or die very suddenly as cases of Anthrax, and bury them whole, if no professional aid is at hand. As will be described later in a leaflet on Anthrax, this is very necessary because human beings can contract Anthrax and die from it.

If the carcass of an animal, which has died of Hæmorrhagic Septicæmia after showing the symptoms described above, be opened it will be found that the swelling of the head and neck is due to thickening of the skin and the collection of a large amount of a yellowish fluid, in which will be found numerous 'hæmorrhagic' or blood spots, in the tissue immediately under the skin.

In the carcass of an animal which has passed through all the symptoms described, these blood spots will also be found on the lining membrane of the throat, lungs and heart, and on the outside of the intestines as they lie in the abdomen, but when the attack has been a very sudden one they are often absent altogether. Nearly all cattle which have died suddenly of Hæmorrhagic Septicæmia show a collection of the yellow fluid under the skin of the head and neck, but, as stated above, this is also sometimes found in cases of Anthrax. If the case is one of Anthrax however, the blood will be found to be like tar and the spleen will be very enlarged, so that if these things are noticed no further cutting should be done but the carcass should be closed up as well as possible and buried or burnt immediately.

When the poison of this disease attacks the lungs, the animal, in addition to showing the usual signs of fever, will stand with its legs apart, back hunched, head extended, and nostrils dilated; it will have a painful cough and in fact show all the signs of a severe inflammation of the

lungs. At the same time it may also show the same signs of intestinal trouble as were described before.

Young animals may die from the lung form of the disease in a few hours, but usually it takes longer to kill an animal than the throat form does, and may last as long as eight days. If the lungs are examined after death a large quantity of the same yellowish fluid will be found both in the lung vessels and in the lung cavity, and if the attack has lasted for several days patches of the lungs may be found thickened and perhaps containing a material like cheese.

When sheep are attacked by Hæmorrhagic Septicæmia they usually suffer from the combined lung and intestinal forms, but the disease does not kill old sheep as quickly as it does cattle, as a rule. It affects lambs, however, more than older sheep, and may cause many deaths among them when they are weak and in poor condition, as for example during the lambing season and when they are being weaned.

The lung form of Hæmorrhagic Septicæmia is not likely to be mistaken for any other contagious disease of cattle and sheep in this country, but very often it is thought to be ordinary pneumonia and its contagious character not realized at all. Several such cases occurring in a herd or flock, however, should make an owner suspicious.

The mortality from this disease is very high; sometimes as many as 90 per cent of the animals affected die from it, so that this, together with the fact that it usually runs a very rapid course in cattle, makes treatment of affected animals difficult and seldom of any use. Small doses of antiseptics like Carbolic acid (½ to 1 dram) and Phenyle (½ to 1 oz.) well diluted with water have been tried, but it is usually impossible to drench the animal.

Our attention therefore should be directed towards preventing its spread among the other animals in the herd, and it is fortunate that we can do this if we remember where the poison is to be found. When an animal is suffering from this disease it is passing out the poison in its saliva, fæces, and urine, so that it should be isolated at once and all its droppings carefully collected and burnt. When the animal dies it should not be opened, for its blood contains the casual organism in large numbers, but it should either be burnt or buried in lime at a depth of six feet. After putting the carcass into the hole its hide should be slashed with a knife to prevent chumars digging it up again and removing the hide. If the carcass is opened before burial the ground on which it was lying should be removed and burnt or buried with it. The walls and pillars of the stall, it was in, should be scraped, and if the floor is an earthen one about two inches of it should be removed, and all this refuse should be

burnt with the carcass, together with any ropes, feeding baskets, etc., used by the dead animal. The walls and pillars of the stall, and the floor if a stone one, should then be well washed down with a solution of Phenyle and afterwards given a coating of Limewash. If the roof is a thatched one it would be a good thing to remove this and so let sunlight into the stall, which should not be used again by a healthy animal for a month. If affected animals are not isolated they are a source of danger to other animals, as the disease may be conveyed directly from one to the other by means of insects, and if the carcasses of dead animals are not disposed of in the way described, but are skinned and the blood spilt, the piece of land on which this happens will be infective to other cattle, and if any of the carcass is removed by men, dogs, or jackals the disease will be carried wherever the flesh is taken. It is necessary to burn carefully all the droppings of an affected animal, for if thrown on the land other animals may pick up the poison in their food or water, and if it happens to be raining at the time the poison may be spread over a large area of country through the water. If it is found that in spite of these precautions being taken cases of this disease continue to occur in a village, it is probable that the animals are grazing over a piece of heavily infected land, for which a search should be made. At the same time the Village Munsiff should report the outbreak to the Tahsildar, who will send a Veterinary Assistant to help the ryots to stamp it out.

Enquiries should be made to see if the animals which have recently died of the disease were taken for grazing to any piece of low-lying marshy land, or over a place where animals, which died of the disease in a previous year, were opened or buried, or to a field on which manure has been spread, or to drink at a tank into which a drain from a cattle stall runs.

If so, a change in the grazing and watering places should be made at once if possible.

In many villages, however, this is not possible, and also it may be impossible to point to any particular piece of land or water as being the source of infection, but the Veterinary Assistant has the means of preventing further attacks of this disease by inoculating the animals with a serum, like the serum used against Rinderpest. This serum does not prevent bullocks being worked nor does it put cows off their milk, but it prevents all those inoculated from contracting Hæmorrhagic Septicæmia for about four weeks, even though they are sent at once to graze over a contaminated area, or come in contact with animals actually suffering from the disease.

Some ryots, being wiser than others, may know of a piece of land which always gives Hæmorrhagic Septicæmia to the animals which graze over it, or they may live in a village which is often attacked by Hæmorrhagic Septicæmia at certain seasons of the year, and they might like to have their cattle protected against such attacks before they send them to graze over the infected area, or before the bad season actually begins. The Veterinary Assistant can inoculate cattle in such cases with a vaccine, which will protect them against Hæmorrhagic Septicæmia for at least four to six weeks, and this form of protection is recommended to all large cattle-owners who are troubled every year by this disease.—*Leaflet No* 5. *Civil Veterinary Department, Madras.*

IX

The Dairying Industry in Denmark.

The first co-operative creamery in Denmark was founded in 1875 by several farmers, at Kaslunde, on the island of Funen. Although fairly successful, it was not until the success that attended the establishment of the Hieding Co-operative Creamery, in 1882, that a fillip was given to the movement, which soon spread its ramifications throughout Denmark, and revolutionized dairy practice.

Through the instrumentality of the co-operative creameries, it was possible for the dairy farmer, no matter on what scale he dairied, even if only one cow were milked, to obtain the very highest price for his product. Moreover, it made possible the manufacture of a uniform quality of butter, and so made a reputation on the English market. We visited several of these creameries. There is nothing about the architecture worth mentioning. With the exception of the widespread use of the pasteurizer, the plants are similar to our own. The law provides that all cream intended for the manufacture of export butter must be pasteurized. The regenerative principle is utilized, that is the incoming cold milk is used to cool down the milk that has already been heated to the high degree of 185 degrees F.; at the same time, the cold milk on its onward course is heated correspondingly.

The Danes claim, and experience would seem to justify the claim that the only way of eliminating bad flavours and getting a uniform quality of butter is by pasteurization. Under another legal enactment surprise butter exhibitions are held weekly. The butter is called up by wire, the water content determined, and the product judged by a committee consisting of nine judges, *viz.*, 6 merchants, 2 dairy managers and one consulting expert.

In the provinces, exhibitions are held periodically and judged similarly, but in these instances the factory is made aware when the butter will be called in.

Special dairy schools are in existence for training managers in all the intricacies of dairy science. It is almost impossible to obtain a position in a butter factory without the diploma of one of these institutions. The butter is put up in casks containing 100 lbs. which bear the "Lur Brand" trade mark. This is a compulsory mark for all butter intended for export, and no inferior butter is allowed to leave the country. The bulk of Danish butter is exported to England practically the whole of it being sent direct to the retailers. It is not only produced co-operatively, but sold through co-operative channels. It may be said truly that no other butter-producing country sells its product to consumers in another country at so small an advance on the original price received by the farmer. The writer visited Tooley-street market several times in London, and saw butter from many countries pass through the hands of agents, but not a solitary cask of Danish butter. Very little milk is separated on the farm, and that is no doubt, a factor in the production of a high-class butter. All skim milk, according to law, must be heated to a temperature of 176 degrees F., before being returned to the farmer. The danger of spreading tuberculosis is minimized greatly in this way. There are over 1,200 co-operative creameries in Denmark, having a turnover of about £21,000,000.

The Cattle.

The chief breeds of cattle number four, *viz.*, Black and White Jutland, Red Danish, Shorthorn, and Jersey. The two former are native breeds and the two latter imported. The Black and White Jutlands are found in the north of Jutland and are regarded as dual purpose cows. The characteristics of the breed are its black and white, or grey or fawn colour, a big frame, with capacious belly, udder well developed, fore and apt, wide between the hips, hide soft, and hair fine; a vigorous cow, always in good condition. The milking capacity, of course, depends on the family, individual, and breed. In a good herd the mature cow would average about 7,000 lb. of milk, with a fat test 3·2. The Red Danish is found in the south-east of Jutland, and the islands of Lolland, Langeland, and Funen; in fact, the majority of the cows belong to this famous breed. They are of the dairy type, and of a beautiful red colour, with a harmonious frame, udder well developed, and splendid teats. They possess to a large degree the power of transmitting to the progeny their milking propensity. The Red Danish is more

productive than the black and white breed for dairying, but not so good for beef.

The Shorthorn is, of course, well known, and in some districts of Jutland has a high reputation as an animal of quick growth, of good beef qualities, and a good milker. Jersey cattle are scattered all over Denmark. They have made great headway during recent years, and one well known stock expert ventured the opinion that the Jersey, in a few years, would be the principal dairy animal in that country.

The high productiveness of Danish cows is recognized the whole world over. That reputation has been achieved through the agency of two very ingenious co-operative undertakings initiated some few years ago—The Cow Testing Associations and Bull Clubs.

Herd Improvement.

The object of the Cow Testing Association is to let the farmer know the amount of milk and butter each cow produces, so that he can discard the unprofitable numbers of his herd, and use the best cows for breeding purposes. The Dane, while recognizing the importance of the various points indicating milking qualities, requires more exact knowledge as to this milking capacity of the cows. The Original Control Society, as it is called, was established in 1895 at Vejon, Jutland. When the first report of the operations of the Society was made available by Mr. Jens Johansen, it startled the whole dairying community. The report stated, *inter alia*, that while with the best cow it cost 6 *d.* to produce 1 lb. of butter, in the case of the poorest it cost 2 *s.* 8 *d.* An example was given of two cows that stood side by side in the shed, both getting exactly the same feed, care, and attention. No. 1 gave 7,810 lb. of milk, with a butter fat test of 4.26, equalling 385 lb. of butter: No. 2 gave 8,226 lb. of milk, with a test of 2.93, producing 280 lb. of butter. Although No. 2 gave 416 lb. more milk, No. 1, with her higher test, yielded 105 lb. more butter. Such a revelation caused the movement to spread, and to-day there are about 700 Cow Testing Associations, with a total of 16,600 members, owning 225,000 cows. Some of the more advanced societies also keep records of the amount of food consumed by each cow. The following figures show the increase in the average yearly yield of butter-fat per cow between the years 1854 and 1918:—

1854 at 44 lb.	1903 at 173 lb.
1861 at 68 lb.	1914 at 215 lb.
1871 at 96 lb.	1918 at 240 lb.
1898 at 129 lb.	

As might be supposed, the greatest increase has taken place since the initiation of the Control Societies ; and, according to the latest figures available, the average yield per cow is 240 lb. The Australian average is estimated at about 150 lb. so we have a long way to go to reach the Danish figures.

Mr. Lars Frederiksen, one of Denmark's foremost stock experts, gave some information about the work of these associations. The work of the society is done by a Control Assistant, who is specially trained for his duties at one of the Agricultural High Schools. The tester visits the farm, identifies the cows, weighs the milk yielded during 24 hours by each cow, tests a composite sample for butter fat content, and enters the figures in a record book, in which a page is set apart for each cow. This is done fortnightly. The tester, also, during his visit, marks any calves born since his previous visit, notes the date of birth, sex, also the names of sire and dam.

Reports of the year's working are furnished, and dealt with in this way ; in the first place, all cows that have produced 385 lb. of butter are picked out ; secondly, if they had a herd-book bull as a sire a card is filled out as a record. This is considered very important, so that information may be available as to which of the herd-book bulls give the best offspring as far as milk and fat production is concerned. It is found that there is a great variation in value of bulls as sires — the offspring of some bulls give less milk and butter than the mothers did. Mr. Frederiksen gave an example of such a bull with a negative breeding value. A bull, herd-book No. 1529, had eleven daughters, after their first calving produced 5,291 lb. of milk, 3.42 test, and 180 lb. of butter-fat. The dams of those young cows, after their first calving produced 6,017 lb. of milk, of 3.75 test, and 25 lb. of butter-fat. In other words, the offspring produced, after their first calving, 726 lb. of milk, and 45 lb. of butter-fat less than their dams did. On the other hand, a bull named "Emb Britten," had 18 daughters, the average production of which in six years was 6,809 lb. of milk, 3.71 test, and 281 lb. of butter-fat. The dams of these eighteen cows in six years averaged 6,140 lb. of milk, 3.36 test, and 206 lb. of butter-fat. This means that the bull "Emb Britten" increased the production of his daughters by 75 lb. of butter-fat per year ; whereas herd-book No. 1529 had decreased the yield of his daughters by 45 lb. per year.

The Bull Clubs and Control Societies work hand in hand, their aim being the improvement and development of dairy cattle by purchasing bulls of a recognized breeding strain, and running them with the best

cows. In this way, the improvement of dairy cattle, instead of being restricted to the big breeders who can afford to buy the best sires, is shared by the smallest farmer, who has his cows served by the very best bulls available through the Bull Club. In 1918, there were 950 such clubs, owning 1,050 bulls, with 25,000 members, in possession of 250,000 cows. No bull belonging to the dairy type can get a prize at a Danish show unless his dam's record is known. In the show catalogue, the female ancestors' records are furnished, and the bulls judged from three different stand-points, *viz.*, (1) The animal itself. (2) The records of his female ancestors. (3) The pedigree. In some classes the bull is judged on his progeny.

Feeding.

Every care is taken that the cows are well and economically fed. When grazing, they are tethered and given limited radii in which to graze and the picket pegs frequently shifted. The large amount of roots fed to cows in Denmark is surprising; in fact, they form the bulk of the ration in hand feeding. A typical winter ration for a cow producing 25 lb. of milk or over is 5 lb. of oil cake, 2½ lb. of hay, and 80 lb. of roots.—*Journal of the Department of Agriculture, Victoria.*

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View 1. — Cane varieties under trial, on the left — Green manure crop of Cowpea in the foreground.

View 2.—Showing H.M. 544 sugarcane bulk crop on the left.